Macroeconomic stability and economic growth in developing countries

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PREFACE

Writing this thesis has been an experience that has taught me a lot. It would not have been possible without all the help I have gotten from friends, family and helpful academic staff at the university. I want to thank my supervisor Halvor Mehlum for guiding me through this work, giving me useful ideas and inputs and motivating me. Thanks to Morten H. Grindaker and Thom Åbyholm for a good collaboration and to Eivind H. Olsen, Bjørn G. Johansen, Eirik Brandås, Frikk Nesje, Sarah Anderson, Mari B. Solheim, Asbjørn Rødseth and Andreas Kotsadam for useful discussions and comments. Thanks to Michael F. Bleaney for inspiring me to replicate his analysis and for helping me understand some of the technicalities in it.

I also want to thank my family for supporting me and believing in me, and especially my nephews Olai and Peder for reminding me that there exists a life outside Stata – and for being an inspiration.

Last, but not least, I want to thank Ingunn (who hates this thesis more than anything) for being so loving and patient.

SUMMARY

Understanding how policy measures affect long term economic growth in developing countries is not only an interesting academic topic, but a topic of severe importance for the billions of people living in poverty today. A much debated topic in the 1990s was the relationship between macroeconomic policies and growth in developing countries. This debate was made relevant by the structural adjustment programs initiated by the World Bank and the IMF to make developing countries pursue policies that they perceived to be promoting growth. An important part of these structural adjustment programs was promote a stable macroeconomic framework.

One of many research papers investigating the relationship between macroeconomic stability and economic growth is Michael Bleaney's (1996) "Macroeconomic stability, investment and growth in developing countries" published in *Journal of development economics*. He intended to test whether the quality of macroeconomic management has any impact on investment and growth:

> Any [exogenous] shock to the economic system is likely to be reflected in macroeconomic statistics. [...] [G]overnment policy can influence the reaction to the shock but not the shock itself. The issue here is the ability of the government to minimise the destabilising impact of such shocks and to avoid creating unnecessary macroeconomic uncertainty by its own policy decisions. Do countries which are successful in doing this [...] experience significantly higher rates of investment and faster output growth rates than those which fail?
> (Bleaney, 1996, p. 465)

To investigate this question, he does a cross section regression analysis of 41 developing countries. He finds some evidence that his measures of policy induced macroeconomic instability are significantly negatively associated with growth, when controlling for the level of investments. However, he finds no conclusive evidence for a significant association between macroeconomic instability and investment.

Seventeen years has passed since Bleaney (1996) published his article, and since then the debate in the growth literature has emphasized other factors that determine growth. Recent research within the growth literature have emphasized the importance of such factors as institutions, culture and geography in determining growth rates (Acemoglu, 2009). These are also variables that are very persistent over time. If these variables are correlated

with Bleaney's indicators of macroeconomic mismanagement, his estimates would be biased. Do his results still hold when the analysis is extended and country specific effects are controlled for? The purpose of this thesis is to answer that question. The amount of available data is far greater now than 17 years ago. I exploit the opportunities that this additional data gives by doing extended cross section regressions and panel data regressions.

Bleaney (1996) uses the central government budget surplus, real exchange rate volatility, government debt level and the inflation rate as indicators of macroeconomic (in)stability. His results show a negative correlation between budget deficits and growth, and between real exchange rate volatility and growth. I find evidence that high government debt and very high inflation rates are detrimental to economic growth, but I find no evidence that budget deficits or real exchange rate volatility are significantly associated to growth. Neither do I find conclusive evidence that any of the indicators have any impact on the investment rate. I show that Bleaney's results are little robust to exclusion of outliers, and that his results can possibly be explained by omitted variable biases.

Though my results show a statistically significant negative association between initial government debt and growth, and between inflation and growth, the economic significance seems to be weak. I investigate whether a threshold model rather than a linear relationship seems to fit the data better and find evidence that it does. I propose that the initial government debt level and inflation rate have no effect on growth at moderate levels, but when they reach unsustainable levels, they have a serious negative impact on growth rates. To test this hypothesis I include dummy variables for initial government debt above 90 % and average inflation rate above 25 % in the regressions. The results show that the threshold model fits better to the data than the linear model, and that reaching unsustainable levels of government debt and inflation has a strong negative impact on growth rates.

Bleaney (1996) interprets his results as an indication that policy induced macroeconomic instability impedes growth. I find this statement too general, and argue that it is necessary to look at each of the indicators individually. I argue that my results can be explained by *debt overhangs* preventing governments from getting access to credits, and thus inhibiting public – and possibly also private – investment, and by economic contractions during inflation crises.

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1. INTRODUCTION

Understanding how policy measures affect long term economic growth in developing countries is not only an interesting academic topic, but a topic of severe importance for the billions of people living in poverty today. A much debated topic in the 1990s was the relationship between macroeconomic policies and growth in developing countries. This debate was made relevant by the structural adjustment programs initiated by the World Bank and the IMF to make developing countries pursue a policy that they perceived to be promoting growth:

> Macroeconomic stability and rapid export growth were two key elements in starting the virtuous circles of high rates of accumulation, efficient allocation and strong productivity growth that formed the basis for East Asia's success.
> (World Bank, 1993, p. 105)

There are several earlier works trying to find empirical evidence for an association between different indicators of macroeconomic stability or macroeconomic mismanagement and growth. One well known contribution is a paper by Dani Rodrik (1999). He focuses on how the interaction between underlying conflicts between different groups within a country and bad institutions of conflict management disables countries from implementing the necessary macroeconomic adjustments to external shocks, and how this harms long term economic growth. Other influential contributions are Kormendi and Meguire (1985) who find support for Robert Barro's (1980) hypothesis that variability in the money supply adversely affects growth, Stanley Fischer (1993) who finds significantly negative correlations between inflation rates, government budget deficit and currency overvaluation and economic growth in a sample of 101 developed and developing countries, and Michael Bleaney (1996), who's analysis this paper is based on.

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Bleaney (1996, p. 476) interprets his results as an indication that policy induced macroeconomic instability impedes growth. I find this statement too general, and argue that it is necessary to look at each of the indicators individually. I argue that my results can be explained by *debt overhangs* preventing governments from getting access to credits, and thus inhibiting public – and possibly also private – investment, and by economic contractions during inflation crises.

I will start by presenting some economic theory that explains the channels through which macroeconomic instability might affect economic growth (in chapter 2). The methodology used by Bleaney (1996) and in this paper will

[1] I used *Stata* to calculate all estimates in this thesis.

be laid out in chapter 3, while the issue of measuring macroeconomic stability will be assessed in chapter 4. The main results are presented in chapter 5. Further investigation and discussion of potential methodological problems as well as causal linkages will be discussed in chapter 6, before I draw some concluding remarks in chapter 7.

2. THEORY

The possible theoretical linkages between macroeconomic stability and economic growth are many. I will not try to give a complete review of them here, but I will highlight some of the possible linkages that I find most relevant.

Before looking into the theories, I find it useful to explain what I mean by macroeconomic stability. The World Bank describes the macroeconomic framework as stable "when the inflation rate is low and predictable, real interest rates are appropriate, the real exchange rate is competitive and predictable ... and the balance of payments situation is perceived as viable" (World Bank, 1990). One could also include stability in output (as measured by GDP) and unemployment rates, which for many is the first thing that comes to mind when they think about macroeconomic fluctuations. However, for reasons explained below, these are not included as indicators of good macroeconomic management in this thesis.

When facing an external shock, the government may face a dilemma where it has to choose between stability in inflation, real exchange rates and a viable fiscal policy on the one hand and stability in output and unemployment rates on the other. Choosing stability in the latter at expense of the former is often perceived to be bad macroeconomic management, because it is detrimental to output and unemployment rates in the long run (Kydland and Prescott, 1977). I will not enter into a discussion about which policy is best in the long term. This can probably vary from case to case, depending on a wide range of circumstances. However, I will focus this thesis on the impact that a low and stable inflation, a stable real exchange rate and a viable fiscal policy have on growth, ignoring potential effects of fluctuations in output and unemployment.

I will first look into what economic theory tells us about the effect macroeconomic instability can be expected to have on investments. If macroeconomic instability is inhibiting growth through depressing investments, as the World Bank (1990) believed, it must be so that higher investment rates cause higher growth rates. Though the empirical evidence of correlation between investment and growth is robust, the causal relationship is far from agreed upon among economists. I will therefore shortly present theoretical frameworks that seek to explain this relationship.

In the last two sections of this chapter I will present some theoretical considerations on how different aspects of macroeconomic instability can affect growth more directly, through its effect on total factor productivity rather than through its effect on the investment rate.

2.1 The effect of macroeconomic instability on investments

One of the most obvious linkages between macroeconomic instability and growth, also emphasized by Bleaney (1996), is the effect macroeconomic instability might have on investments. Greater macroeconomic instability increases uncertainty about the returns to investments through at least three channels. Instability in inflation rates and nominal exchange rates causes a higher *real exchange rate risk* for investors investing in export oriented and import dependent production, because their future earnings depends on these highly instable variables. Variability in inflation and exchange rates affect *domestic demand* both directly and indirectly. Directly by affecting the terms of trade, and thus shifting demand from domestically produced goods to imported goods or the other way around. Indirectly through affecting the level of production, and thus income and consumption demand. This increases the uncertainty about future earnings of firms and thus the risk of the investments. High macroeconomic instability may also cause *political instability.* It is often seen that for example periods of high inflation generates social unrest and political discontent (Paldam, 1987). This may be because the wages of the poor do not keep up with the prices of necessity goods, or because it induces higher job insecurity through depressing production. Higher political instability may be an important factor in assessing the risk of an investment, and is shown to be negatively correlated to the level of investments (Rodrik, 1991).

The average *central government budget surplus* and the *initial government debt* are used as indicators of macroeconomic (in)stability in this thesis. These variables deserve some special attention here, because they are likely to affect investment in physical capital in other ways than through generating uncertainty about the future.

Budget deficits normally have to be financed throug borrowing. If some of the debt is borrowed at the domestic market, this increases the demand for funds in the domestic credit market. If the country is not fully financially open, this will contribute to increasing the interest rate (Edwards and Khan, 1985). A higher interest rate means that some of the investments that would have been profitable with a lower interest rate no longer are, and thus investments in productive capital will be reduced due to an increase in government borrowing. Blinder and Solow (1973) refer to this situation as *crowding out* of investments in real capital.

If the initial level of government debt is high, the chance that the government will be unable to service its debt increases. At some point the investors will realize that it is unlikely that the country will be able to repay its debt. This means that they will refuse to lend any more money to the country, or at least demand a very high interest rate, so that the country in practice is unable to borrow. Without access to credit the government will no longer be able to finance public investments, even the ones that would have yielded great returns. Krugman (1988) refers to this situation as a *debt overhang.*

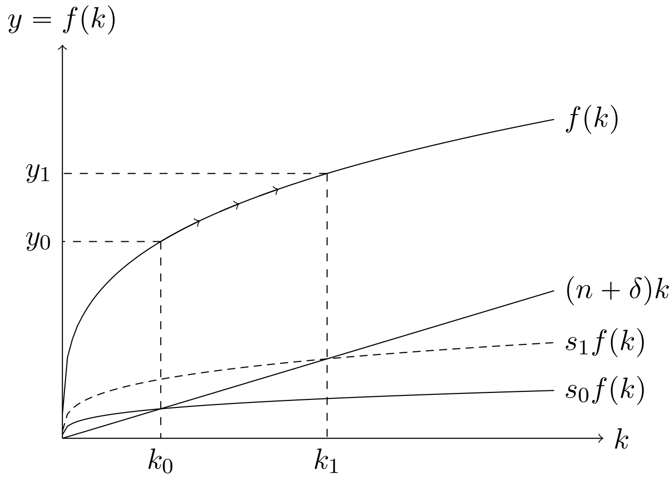
2.2 Links between investment and growth

If macroeconomic stability promotes growth through the investment channel, it must also be so that investment promotes growth. Empirically, the correlation between investment and growth is one of the most statistically robust ones in the growth literature (Levine and Renelt, 1992). However, there exists no consensus on the causal relationship between them. I will therefore spend some time discussing some theories that can explain this relationship. I will first present two models that explain how investments generate growth, namely the *Solow model* and the AK model. Thereafter I will present some theoretical explanations to why the correlation between investment and growth is high even though investment does not generate sustained economic growth.

2.2.1 Investment generated growth

In the classical *Solow-Swan model*, sustained economic growth can only be achieved through technological progress. Increasing the investment rate will cause an increase in the level of capital per worker, and thus in the per capita output. The growth will continue until the depreciation and dilution of capital equals investments (see Fig. 1).

Fig. 1: Investment induced growth in the Solow model



This growth is temporary, and only lasts from one steady state to another, but how long this takes depends on the parameter values. To get an idea about what the Solow model predicts, let's take a look at an example:

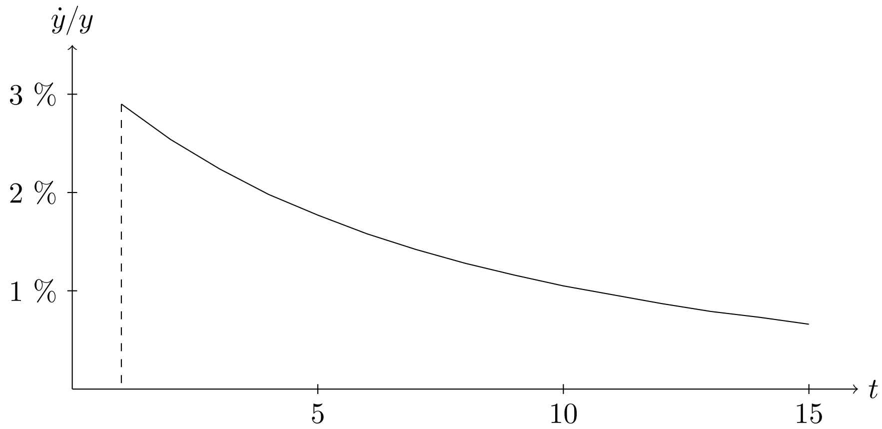
$$\textit{Product function:} \quad F(K,L) = AK^{\alpha}(hL)^{1-\alpha}, \quad 0<\alpha<1 \tag{2.1}$$

$$\textit{In per capita terms:} \quad f(k) = Ak^{\alpha}h^{1-\alpha}, \qquad k = K/L \tag{2.2}$$

$$\textit{Steady state:} \quad sf(k) = (n+\delta)k \tag{2.3}$$

Where A is a measure of productivity, K is physical capital, L is labor, h is human capital, n is population growth and δ is the depreciation rate of physical capital. For simplicity, I will set $A = h = 1$, and assume that there is no population growth, no technological growth and no growth in the level of human capital. To see how an increase in the investment rate (s) affects growth in the Solow model, let's set $\alpha = 0.3$ and $\delta = 0.1$, and see what happens if the investment rate increases from 0.1 to 0.2. Fig. 2 shows how the growth rate develops over time after a jump in the investment rate from 0.1 to 0.2 in period $t = 1$. We see that this increase in investment rate contributes to a significantly higher growth rate, even 14 years after the increase. Keeping in mind that the parameter values are speculative and the increase in investment rate might be implausibly large, we see that it is not impossible that part of the differences in growth rates among countries can be explained by differences in investment rates, even within the Solow model framework.

Fig. 2: Investment induced growth rate in the Solow model



If we have a product function where capital is not subject to diminishing returns, sustained growth can in fact be achieved through capital accumulation. The *AK model* is a growth model where there are constant returns to capital:

$$\textit{Product function:} \quad F(K(t)) = AK(t) \tag{2.4}$$

$$\textit{In per capita terms:} \quad f(k(t)) = Ak(t) \tag{2.5}$$

$$\textit{Growth rate:} \quad \frac{\dot{y}}{y} = \frac{\dot{k}}{k} = sA - n - \delta \tag{2.6}$$

Here, we see that as long as

$$s > \frac{n + \delta}{A}$$

economic growth will continue forever as a result of capital accumulation. Even though the AK model offers an explanation to the observed relationship between investment and growth, it seems completely unreasonable theoretically. Imagine a worker at a factory who needs a certain machine to work. If he has one machine, and we give him another one, he becomes twice as productive. If we give him two new machines, his productivity doubles again, and so on. It seems theoretically implausible that this process can go on forever without the marginal productivity of en extra machine to be decreasing.

However, Romer (1986) argues that if knowledge is a by-product of capital accumulation and knowledge is non-rival and an important factor in the production function, there might in fact be constant or even increasing returns to scale of capital accumulation. To see why, consider the following production function:

$$Y = AK^{\alpha}L^{1-\alpha}Z^{\eta} \tag{2.7}$$

$$y = Ak^{\alpha}Z^{\eta} \tag{2.8}$$

$$Z(K) = BK = BkL \tag{2.9}$$

$$y = A(BL)^{\eta}k^{\alpha+\eta} \tag{2.10}$$

Where Z is knowledge, which is an increasing function of the level of capital accumulated. Now, we see that if there is no population growth and $\alpha+\eta = 1$, this is essentially the AK model, with constant returns to scale.

2.2.2 Other explanations to the relationship

In addition to these theories on how investments promote growth, I want to emphasize three different explanations to why the correlation between investment and growth is not necessarily a sign that investment generates sustained growth.

One explanation to the correlation between investment and growth that can also be explained within the framework of the Solow model, is that countries have different production functions. Some countries are able to adopt new technology that makes capital much more productive. In the Solow model we can think of this technology shift as a shift to a higher α. As shown below (eq. 2.12), a higher α means a higher optimal rate of investment. If this new technology facilitates growth and leads to a higher investment rate, this might be an explanation to why the correlation seems to be so robust.

$$\textit{Optimal level of k:} \quad f'(k) = \alpha Ak^{\alpha-1}h^{1-\alpha} = n+\delta$$

$$k^* = \left(\frac{n+\delta}{\alpha A}\right)^{\frac{1}{\alpha-1}} h \tag{2.11}$$

$$\textit{Optimal savings rate:} \quad s^* = \frac{(n+\delta)}{A}k^{*1-\alpha}h^{\alpha-1}$$

$$s^* = \frac{(n+\delta)}{A}\left(\frac{n+\delta}{\alpha A}\right)^{\frac{1-\alpha}{\alpha-1}} h^{1-\alpha+\alpha-1} \tag{2.12}$$

$$s^* = \alpha$$

The other two explanations can be thought of within the framework of a simple Keynes model. If the economy has free production capacity, and the supply responds to demand, increased investment would directly lead to a higher output. This is simply because the investments themselves generate economic activity by utilizing workers and capital that would not otherwise be in use, and not because new machinery or infrastructure makes production more efficient.

A third explanation to the relationship is that it is growth that causes investments, and not the other way around. This might be because firms receive high profits in years of high growth, and they use this profit to invest in new capital. It might also be that investors invest more when they expect high growth, because high growth means high demand and high profits.

The main message from this section is that it is not clear that investments generate sustained growth, even though this is often taken for granted by some economists. If investments do not generate growth, it cannot be the case that macroeconomic stability promotes growth through its effect on investments.

2.3 Relative prices and allocation of factors of production

In addition to the possibility that macroeconomic instability affects growth through its effect on investment, in this and the following section, I want to present theories that explain how it can affect productivity more directly. The first theoretical argument, also emphasized by Fischer (1993), is straight forward and focuses on the effect macroeconomic instability has on an efficient resource allocation.

In order for free markets to secure an effective allocation of resources, one of the conditions that has to be fulfilled is that all actors have accurate information about relative prices. If inflation is high and unstable, it is hard for a producer to know what the prices and wages will be in the future. It is also very likely that it will be hard to know what the price of the output good will be relative to the price of inputs, and thus hard to plan how much to produce and how much to use of each input. This can cause large inefficiencies, in the sense that production will be lower than what would have been possible if there was certainty about relative prices (Fischer, 1993).

2.4 Outward orientation, instability and industrial clusters

The relationship between trade orientation and economic growth is probably one of the most debated topics in the growth literature (see e.g. Dollar, 1992; Sachs et al., 1995; Rodriguez and Rodrik, 2001). There is no clear academic consensus on whether outward orientation promotes growth, and if it does, through which mechanisms it works. Different theories focus on how outward orientation gives an economy access to financial capital from abroad, to new technology and lets the economy increase total factor productivity by moving factors to sectors in which it has a comparative advantage (Acemoglu, 2009).

New trade theory (see e.g. Krugman, 1991) focuses on how access to larger markets allow countries to benefit from economies of scale. This is the theory I will use (in this section) to explain how instability, especially through real exchange rate volatility, can have a negative impact on growth.

Underlying the assumption that real exchange rate volatility increases uncertainty about profits in the export sector, lies a simple profit function, where a firm receives its revenue in foreign currency and pays expenses in domestic currency:

$$\Pi(P_*, E, P) = R(P_*, E) - C(P)$$

Where Π is profit, R is the revenue function, C is the cost function, P_* is the price level abroad, P is the domestic price level and E is the nominal exchange rate. R is increasing in P_* and E, while C is increasing in P, and thus Π is increasing in P_* and E, and declining in C. Since the real exchange rate is defined as $RER = \frac{P_* E}{P}$ it is a good approximation that the profits in the export sector depend positively on the real exchange rate:

$$\frac{\partial \Pi}{\partial RER} > 0$$

For firms producing for the domestic market, but relying on imported inputs, the relationship would be the opposite, but volatility in the real exchange rate will have the same effect for both types of firms. To keep the discussion simple I will focus on firms in the export sector, but the arguments also hold for firms producing for the domestic market with imported inputs.

Real exchange rate volatility increases the risk for investments in the export sector, which means that investors would require a high risk premium for being willing to invest in the export sector, which in turn will lead to a low level of investments in the export sector. This is only part of the story, because increased exchange rate volatility also means that the frequency of firm bankruptcy will be high in this sector. This is especially true in countries with poorly developed financial markets. To illustrate why, I will present a very simple model based on Aghion et al. (2009).

Imagine that in order to continue production in period $t + 1$ the firm has to pay a cost I in period t. Think of this as an investment that the firm has to do before every period. If there are no credit constraints, the firm will choose to pay the cost and continue production, as long as the expected profit in period $t + 1$ is greater than the cost in period t:

$$I_t < \beta E(\Pi(RER)_{t+1}), \qquad \beta = \frac{1}{1+r}$$

Where r is the discount rate. However, if there are credit constraints an additional requirement for production to continue is that the firm has enough liquidity to finance the investment. Let the amount the firm is able to borrow in period t equal $(\mu - 1)\Pi_t$, where μ is a measure of financial development.

The total amount of liquidity the firm has available in period t is then $\mu\Pi_t$. The additional requirement then becomes:

$$\mu\Pi_t > I_t$$

Here we assume that the firm does not save any of its profits from one period to another. This assumption might seem unrealistic, but it might not be unreasonable for small and new firms that have not been able to acquire much equity.

We see that if the level of financial development (μ) is low and the real exchange rate was low in one year, the firm might not be able to pay the necessary cost to continue production in the next year. An implication of an increased real exchange rate volatility is that, for a given level of financial development, the likelihood of being unable to finance the cost of continuing production increases.

Furthermore, this high frequency of firm bankruptcies might hinder the development of industrial clusters, where firms benefit from economies of scale. Marshall (1920) showed how industrial clusters may help firms to compete, due to the presence of economies of scale. He focused on three important sources to economies of scale: The presence of a *pool of specialized workers*, easy access to *suppliers of specialized inputs and services* and *knowledge spillovers* between firms. Higher frequency of firms going out of business is likely to reduce the presence of all these positive externalities, and thus hinder development of the cluster itself.

In an industry cluster where different firms have very specialized tasks, all firms depend on many other firms. Producers of final goods depend on subcontractors that deliver very specialized inputs or services, while producers of inputs and services are so specialized that they are dependent on delivering their outputs to specific producers of a final good. Their equipment and knowledge is so specialized that they cannot easily shift production to something else if their costumer goes out of business. If one producer of a final good goes bankrupt, it is likely that some of the firms delivering inputs and services to that firm also will go bankrupt. These firms might have been crucial to other producers of a final good, and their disappearance may cause problems for that firm, and so on. This puts an effective end to any development of industrial clusters.

Building up specialized knowledge about production takes time. The longer a firm lives, the more knowledge it manages to build up, at least up to a certain age. If knowledge spillover is an important source of economies of scale, then firms will benefit more from positive externalities, the more old firms there are. Hence, a higher rate of firm bankruptcies hinders this source of economies of scale.

There are many factors that have to be in place for a cluster to develop. Without the economies of scale stemming from specialized suppliers and knowledge spillovers it is also unlikely that a pool of specialized workers should emerge.

Hence, high real exchange rate volatility makes it unlikely that industry clusters develop, and therefore countries with high real exchange rate volatility are unable to take advantage of this aspect of openness.

In this chapter I have shown that macroeconomic instability can be expected to affect growth through at least three channels. The first is the adverse effect it may have on capital accumulation. The second is more directly by inhibiting total factor productivity by making the price mechanism less efficient, causing an efficient allocation of factors of production (Fischer, 1993). The third is through hindering development of industrial clusters. In the next chapter I will discuss how we can empirically investigate to what extent macroeconomic instability affects investment and growth.

3. METHODOLOGY

If suitable measures of macroeconomic stability can be found (I will return to this question in chapter 4), Bleaney (1996) argues that the effects macroeconomic instability have on growth can be tested through a well established framework for empirical testing of growth models (see e.g. Barro, 1991; Levine and Renelt, 1992). In this chapter I will first present the methodological framework used by Bleaney (1996). I will then present how I will extend his analysis, before I discuss one of the most serious shortcomings of our methodological frameworks, namely that we ignore the fact that the investment rate is most likely endogenous.

3.1 The framework used by Bleaney (1996)

The framework Bleaney (1996) uses is the following:

$$GR_i = \alpha + \psi INV_i + \boldsymbol{X_i\beta} + \boldsymbol{Z_i\gamma} + \epsilon_i, \qquad i = 1, ..., n \tag{3.1}$$

Where GR is the growth rate of GDP per capita, INV is a measure of the growth rate of physical capital, $\mathbf{X}$ is a vector of control variables, $\mathbf{Z}$ is a vector of indicators of macroeconomic stability and α is a constant. The subscript i denotes that this is the observation for country i. The underlying theory behind this framework is the neoclassical growth model, with physical and human capital and labor as the factors of production. As a proxy to the growth rate in physical capital, he uses the ratio of investment to GDP. The significance of this variable in growth regressions is the most consistent result in previous research (Levine and Renelt, 1992). The variables he chose to include as controls were (with some modifications) the variables that Levine and Renelt (1992) found as robust determinants of growth. Their study tested the robustness of many variables that have been suggested as conducive to growth. In addition to the investment rate, the variables they identified as robust were the initial level of per capita GDP, population growth and the level of schooling (as measured by the ratio of secondary school enrollment). In addition to these, Bleaney (1996) includes the growth rate of the exports to GDP ratio as a control variable. He excludes the ratio of secondary school enrollment, because it appears as insignificant in his regression.

Including the variables identified as robust by Levine and Renelt (1992) can also be justified from a theoretical point of view, in the sense that outside of the steady state (and with no technological growth), these are proxies for the factors that will determine the growth rate in a Solow model, in the short term. Bleaney (1996) does not go into why he includes the growth rate of the exports to GDP ratio as a control variable, but one obvious reason for including it is that changes in foreign demand causes an increase in the price of exports, which automatically will lead to an increase in GDP.

Bleaney (1996) uses a similar framework to test the impact of macroeconomic instability on investments:

$$INV_i = \delta + \boldsymbol{V_i}\boldsymbol{\phi} + \boldsymbol{Z_i}\boldsymbol{\rho} + \eta_i \tag{3.2}$$

Where $\boldsymbol{Z}$ is the same vector of indicators of macroeconomic stability as in eq. (3.1), $\boldsymbol{V}$ is a vector of control variables and δ is a constant. Levine and Renelt (1992) also tested the robustness of different variables that were proposed as being conducive to investment. The only variable they identified as robust was the exports to GDP ratio as a measure of openness. In addition to using the initial ratio of exports to GDP, Bleaney (1996) uses the average growth rate of the exports/GDP ratio as well as the index of real exchange rate distortion calculated by Dollar (1992) for the period 1976-85.

3.2 Extending the analysis

Due to lack of data on real exchange rate distortion in the 1990s and 2000s, I have not included this variable in any other regressions than the replication of Bleaney (1996). Other than that, I have used the same control variables as Bleaney (1996) in all of the regressions in this paper. As a measure of human capital, I attempted to include the average attended years of education in the regressions. Strictly speaking, a measure of growth in human capital would be more in line with the neoclassical model, but education might also be thought of as a factor that drives technological growth. When time dummies were not included in the panel regressions, this variable appeared as very significant, but when dummies for the 1990s and 2000s were included, this effect disappeared. This is most likely because there is an upward sloping trend in years of education for almost all countries, combined with the fact that the average growth rate for the countries in my sample is higher in the 1990s than in the 1980s, and higher in the 2000s than in the 1990s. So that the education variable only picked up this upward sloping trend in growth for developing countries. The results for the variables of interest were not sensitive to whether I included it or not. This, and also because I did not have available data on education for all the countries, led me to not include it as a control variable.

The first extension I will do is to include more countries to the regression. I include all countries that were defined as developing countries by the IMF in 1980 for which there is available data, and do three separate regressions; for 1980-89, 1990-99 and 2000-2009 (section 5.2). These are cross section analyses with the average values for each decade. I also do a pooled ordinary least squares (OLS) regression with up to three observations per country (one per decade).

I will then turn to the major methodological improvement, compared with Bleaney's analysis. I will exploit the fact that I have data on the same countries for three decades,[2] by doing a *fixed effect panel regression* (section 5.3), using the following framework:

$$GR_{it} = \alpha + \psi INV_{it} + \boldsymbol{X_{it}\beta} + \boldsymbol{Z_{it}\gamma} + d_t + a_i + \epsilon_{it} \tag{3.3}$$

$$INV_{it} = \delta + \boldsymbol{V_{it}\phi} + \boldsymbol{Z_{it}\rho} + d_t + b_i + \eta_{it} \tag{3.4}$$

Where the GR, INV, $\boldsymbol{X}$, $\boldsymbol{V}$ and $\boldsymbol{Z}$ are as defined above, and the subscript it denotes that this is the observation for country i in time period t. The variable d_t is a time dummy (one for each period except the first) to capture time trends, while a_i and b_i are time constant country specific effects that affect growth and investment. These country specific effects can be anything not included in the regression that affects growth equally for all the time periods. For instance we might expect institutional environment or some cultural aspects to have an impact on growth. These variables are typically relatively persistent over time within a country. When doing a standard cross section regression, it is not possible to control for this country specific effect unless we have some kind of measure for it. When doing a panel regression, however, the mean for a country is subtracted on both sides of the equations such that the country specific effect is controlled for:

$$GR_{it} - \overline{GR}_i = \psi(INV_{it} - \overline{INV}_i) + (\boldsymbol{X_{it}} - \boldsymbol{\bar{X}_i})\boldsymbol{\beta} + (\boldsymbol{Z_{it}} - \boldsymbol{\bar{Z}_i})\boldsymbol{\gamma} + \epsilon_{it} - \bar{\epsilon}_i \tag{3.5}$$

The most serious problem with OLS arises when the country specific effect is correlated with the regressors included in the regression. This causes the estimated coefficients to be biased. If for example high institutional quality[3] is positively correlated with both growth and the central government budget surplus, the estimate for the coefficient of the budget surplus will be upward biased. This means that our estimate would suggest that a positive budget surplus contributes more to economic growth than it really does. When doing a fixed effect regression, however, this effect is controlled for. If there are country specific effects that are not constant over time and these are correlated with growth and the included regressors, there would still be a problem of omitted variable bias. Unless proxies for these variables or valid instruments for the included regressors can be found, there is not much to do about this problem, and there is no way to find out if the problem really exists. However, a fixed effect panel regression is still an improvement compared to a cross section regression.

My panel is an unbalanced panel, which means that I do not have observations for all countries in each decade. This will only cause biased estimates

[2] I don't have observations for all countries in all decades, so it will be an unbalanced panel.

[3] The macroeconomic management are also handled by some institutions. However, this is not what I mean when talking about institutional quality. By institutional quality I mean the degree of rule of law, protection of private property rights and degree of democracy or other deep and persisting institutions in society.

if there is a systematic reason for the variables to be unobserved that correlates with both groth and the regressors. I have not been able to detect such systematic explanations to why data is missing for countries, but it is not impossible that there is one. However, if i were to use a balanced panel, I would be left with very few observations. To see which countries are included in which decade, see Tab. 10 in *Appendix B*.

When doing growth analyses based on panel regressions there is a dilemma between setting the time period short to get as many observations as possible, and keeping the periods long enough to measure what you want to measure. Having many observations is good to make more accurate estimates, by keeping the standard errors down. But if I want to say something about how macroeconomic management affects growth in the long term, I cannot base the regression on, say, 3-year averages. Short period growth rates will be heavily influenced by short term macroeconomic fluctuations. I have chosen to base the regression on 10-year averages. This is long enough to not be very biased by cyclical fluctuations but short enough to give me enough observations to keep the standard errors down.

3.3 Endogeniety of the investment rate

As mentioned in section 2.2 it might be argued that the investment rate depends on the actual or expected growth rate of GDP. If this is the case, the model will be misspecified and the estimates suffer from a simultaneity bias. Bleaney mentiones this possibility (in a footnote), but states that "the existence of simultaneous equation bias was rejected in a Hausman test, and the equations were estimated by OLS." (Bleaney, 1996, p. 469). He is not explicit about what instruments he used to perform the test, but if he based the test on the basic growth equation, the possible instruments are population growth and initial GDP. These variables have very low explanatory power for growth ($R^2 = 0.04$), and according to Hahn et al. (2011) this causes the Hausman test to be invalid. Unless we find stronger instruments for growth, there is no way we can be sure that growth is exogenous to the investment rate. In the absence of good instruments it is also impossible to consistently estimate the equations in a simultaneous equation system.

Even though I find it little convincing that the investment rate is exogenous to growth, I have not been able to find good instruments, or in other sophisticated ways estimate these equations consistently. Doing so would be a methodological improvement, but it is simply too time consuming to be possible in this thesis. I will therefore stick to the framework used by Bleaney (1996), extended by panel regressions.

4. MEASURING THE QUALITY OF MACROECONOMIC MANAGEMENT

In order to assess the effect of macroeconomic management on economic growth it is necessary to find a convincing measure of how well countries handle their macroeconomic management. By good macroeconomic management I mean an economy where the government manages to provide a stable macroeconomic environment, as defined in chapter 2.

Kormendi and Meguire (1985) were among the first to include macroeconomic policy variables in growth regressions. They found that the standard deviation of unanticipated monetary growth was significantly negatively correlated with growth in GDP for a sample of 47 countries over the period 1950-77.

Both Cottani et al. (1990) and Dollar (1992) find real exchange rate variability to be significantly negatively correlated to growth, and Cottani et al. (1990) also concludes that it is negatively correlated with investments. Ghura and Grennes (1993) finds real exchange rate instability to be significantly negatively correlated with investments, but not with growth, in a study of 33 sub-Saharan African countries.

Fischer (1993) uses the inflation rate, the central government budget surplus/deficit and the black market exchange rate premium as indicators of the quality of the macroeconomic management. He argues that the inflation rate is the best indicator of how well a country manages its economy. It is widely accepted that very high inflation rates inhibit an efficient resource allocation and depress investment rates (Fischer, 1993, p. 487). Even though most countries aim for a positive inflation rate, there are no good arguments for very high inflation rates. Therefore high inflation rates may be interpreted as an indication that the government has lost control over the economy.

Some countries manage to keep the inflation rate low and stable for a long time, in an unsustainable way, for example by pegging their currency to a major currency who's economy is in a completely different situation. According to Fischer (1993, p. 487) these countries will most likely face fiscal or balance of payments problems, and the central government budget surplus or deficit will be a good indicator of such an unsustainable situation. As a measure of the sustainability and appropriateness of the exchange rate, he uses the black market exchange rate premium.

Bleaney (1996) chose to focus on four concepts; the *inflation rate*, the *stability of the real exchange rate*, the *budget balance* and the (external) *government debt*. More specifically, he used the five following indicators:

BS - the central government budget surplus (including grants) as percentage of GDP.

SDRER - the standard deviation of the logarithm of the real exchange rate.[4]

CPINFL - average consumer price inflation over the period 1980-90 (value set to 100 % if average inflation exceeded that level).

DEBT79 - ratio of end-1979 foreign debt[5] to 1979 export revenues.

HIC - a dummy variable that equals 1 if the country was classified as a highly indebted country by the World Bank in 1989, and 0 otherwise.[6]

In theory it is primarily variability and thus uncertainty in the inflation rate that inhibits growth (see chapter 2), and ideally the variability of the inflation rate would be a good measure for this. In practice the variance and mean values of the inflation rates are so highly correlated (see Tab. 1), that it is hard to distinguish the effects from one another in a regression. Bleaney (1996) therefore chooses to look at average inflation, and not the standard deviation.

Tab. 1: Correlation between mean and standard deviation of inflation rate

	sd(CPinf)	mean(CPinf)
sd(CPinf)	1.0000	
mean(CPinf)	0.9610	1.0000

In his sample, there are some countries that experienced extremely high inflation rates in some years. In order to avoid that these few observations determine the coefficient estimate, a maximum of 100 % was imposed on the average inflation rate (Bleaney, 1996, p. 466).

Bleaney (1996, p. 466) argues that the central government budget surplus/deficit as percentage of GDP serves as a measure of the quality of fiscal management. Though Keynesians would argue that running a deficit during periods of economic stagnation is a good way to stimulate the economy and thus create macroeconomic stability, this argument does not hold when looking at an 11-year average. The initial level of government debt essentially measures the same thing as the budget surplus, but it measures how fiscal policy was handled in the past rather than at the present.

Bleaney (1996) uses the standard deviation of the logarithm of the real effective exchange rate as a measure of the variability of the real exchange rate. Understanding how to interpret this variable is important in order to assess its importance for growth, when looking at the size of its coefficient

[4] Where it was possible it was calculated from the real effective exchange rate as published in IMF International Financial Statistics, and otherwise from the bilateral consumer price based rate against the US dollar.

[5] Government debt to foreign creditors.

[6] In this sample these were: Argentina, Bolivia, Chile, Colombia, Costa Rica, Ecuador, Morocco, Ecuador, Mexico, Peru, Philippines, Uruguay and Venezuela (Bulow and Rogoff, 1990, p. 31).

estimates in chapter 5. Since this is only to get a vague idea about what the value of the variable means, we can think of the standard deviation as the average deviation from the mean:

$$SDRER = sd(ln(RER)) \approx \frac{\sum_{t=1}^{T} ln(RER_t) - ln(\overline{RER})}{T}$$

And since $ln(RER_t) - ln(\overline{RER}) \approx \frac{RER_t - \overline{RER}}{\overline{RER}}$, we can think of *SDRER* as approximately the real exchange rate's average relative deviation from its mean, i.e. *SDRER*=0.1 means that the real exchange rate had an average relative deviation from its mean of approximately 10 %. This sure is a measure of the predictability of the exchange rate, but it does not measure if the exchange rate is competitive or appropriate. If he also wanted to test this, he could use the black market premium, as in Fischer (1993). However I did not find easily available data for enough countries to include this variable.

I have chosen to use the same indicators as Bleaney (1996), with some small differences. Due to lack of available data on foreign debt, I have chosen to use total government debt as percentage of GDP instead of foreign debt as percentage of exports. Except from the regression where I replicate his results, I will not use the HIC dummy. This is because the World Bank does not have a list of countries classified as "highly indebted countries" anymore. Instead the World Bank, together with the IMF, have classified a number of countries as "highly indebted poor countries" (HIPC), which means that in addition to being highly indebted, a country also has to be sufficiently poor to be labeled a HIPC. Including a HIPC dummy as a regressor would have caused serious exogeneity problems, because being a poor country is a result of having low growth. However the already included debt to GDP ratio is a good measure of how highly indebted the country is, so another measure of this is not really needed. The variables for inflation rate, budget surplus and exchange rate variability are constructed in the exact same way as in Bleaney (1996):

BS - the central government budget surplus (including grants) as percentage of GDP.

SDRER - the standard deviation of the logarithm of the real exchange rate.[7]

CPinf - average consumer price inflation over the period 1980-90 (value set to 100 % if average inflation exceeded that level).

debtX9 - ratio of end-1979 central government debt to 1979 GDP, for the 1980s, and the same ratio for 1989 and 1999 for respectively the 1990s and 2000s.

[7] Where it was possible it was calculated from the real effective exchange rate as published in IMF International Financial Statistics, and otherwise from the bilateral consumer price based rate against the US dollar.

5. RESULTS

For some of the variables I used data from some other sources than Bleaney (1996) did (see *Appendix A* for description of variables and data sources), and for many developing countries the numbers tend to vary depending on the source. Therefore I find it useful to do a replication of Bleaney (1996), using the exact same countries and almost the same variables. As mentioned, I was not able to access data on foreign debt for all the countries, so I used the total central government debt as percentage of GDP, instead of the foreign debt to exports ratio.

As basis for the growth regressions, Bleaney (1996) uses population growth, investment rate, growth in exports to GDP ratio and population growth control variables. He reports the following estimates on the coefficients for these variables:

$$GR = \underset{(0.78)}{0.0218} - \underset{(-1.66)}{0.599}LGR + \underset{(6.28)}{0.273}INV + \underset{(2.10)}{0.118}XYGR - \underset{(-2.50)}{0.00852}LYPC79$$

Figures in parenthesis are t-statistics. GR is the average annual per capita GDP growth rate, LGR is average annual population growth rate, INV is the investment/GDP ratio, XYGR is the growth rate of the exports/GDP ratio and LYPC79 is log GDP per capita in 1979 (measured in USD).

His results for the coefficients of interest are shown in Tab. 2. The countries included in the regressions are those developing countries for which data were available (in his sources at that time).[8]

Except for the coefficient of the inflation rate in column (2), all the estimates in the growth regressions have the expected sign. A higher budget surplus seems to be associated with a higher growth rate, while a higher real exchange rate volatility is associated with a lower growth rate. None of the estimated coefficients on the variables of interest are actually significantly different from zero at a five percent significance level,[9] but the budget surplus/GDP ratio as well as the standard deviation of the (log) real exchange rate (in column (2)) have p-values just above 0.05. Bleaney (1996) also runs an F-test of the hypothesis that all coefficients of interest (for the Z-variables) are zero (results are reported at the bottom of the table). As

[8] The countries included where: Argentina, Belize, Bolivia, Botswana, Chile, Colombia, Costa Rica, Cyprus, Dominican Republic, Ecuador, El Salvador, Fiji, Guatemala, India, Iran, Israel, Jordan, Kenya, Korea, Malawi, Malaysia, Malta, Mauritius, Mexico, Morocco, Nepal, Pakistan, Panama, Paraguay, Peru, Singapore, Sri Lanka, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uruguay, Venezuela and Zimbabwe.

[9] The critical t-value for column (2) is 2.0345 ($df = 41 - 8 = 33$)

Tab. 2: The original results in Bleaney (1996)

Dependent variable: Coefficient of	(1) PCGR	(2) PCGR	(3) PCGR	(4) INV	(5) INV	(6) INV
BS	0.155	0.164		0.386	0.337	0.362
	(1.78)	(2.01)		(1.52)	(1.45)	(1.54)
SDRER ($\times 10^{-2}$)	−4.42	−6.91		−8.86	−1.90	−10.08
	(−1.29)	(−2.03)		(−0.89)	(−0.19)	(−1.35)
CPINFL ($\times 10^{-4}$)	−0.501	0.399		−1.96	−0.584	
	(−0.36)	(0.33)		(−0.47)	(−0.14)	
DEBT79 ($\times 10^{-2}$)	−0.145			0.273		
	(−0.75)			(0.50)		
HIC		−0.043			−3.65	
		(−0.05)			(−1.75)	
INV * *BS*			0.631			
			(1.95)			
INV * *SDRER* ($\times 10^{-2}$)			−2.39			
			(−1.45)			
INV * *PINFL* ($\times 10^{-4}$)			−0.441			
			(−0.60)			
INV * *DEBT79* ($\times 10^{-2}$)			−0.588			
			(−0.69)			
F-statistic	2.29	1.94	3.55	0.88	1.66	1.62
[marginal significance]	[0.08]	[0.13]	[0.02]	[0.49]	[0.18]	[0.21]
n	40	41	40	39	39	39

Figures in parentheses are t-statistics. Additional regressors included are those shown in preferred regressions given in the text. PCGR - average annual per capita GDP growth rate; INV - investment/GDP ratio; BS - average central government budget surplus (% GDP); SDRER - standard deviation of log(real exchange rate); CPINFL - average annual inflation rate (truncated at 100%); DEBT79 - ratio of external debt to exports in 1979; HIC - dummy variable = 1 for highly indebted country in 1989. F-statistic is a test of the hypothesis that coefficients of regressors shown are jointly zero.
Source: Bleaney (1996)

we see, the hypothesis is rejected at a 10 % significance level for two of the growth regressions. This is a fairly strong indication that there actually is a relationship between these four indicators of macroeconomic (in)stability and economic growth.

I will come back to the issue of economic significance in chapter 6, but it's worth to take a look at the size of the coefficient estimates for BS and $SDRER$. If we use the estimates in column (2), we see that a decrease in the average budget deficit (increase in the average budget surplus) with one percentage point of GDP is associated with an increase of 0.164 percentage points in the average growth rate. Put differently, an increase in average budget surplus of six percentage points of GDP is associated with an increase of one percentage point in average growth rate.

Interpreting the coefficient of *SDRER* is a bit harder. Recall that if we interpret the standard deviation as roughly the average deviation from the mean, and remember that the difference between the logarithm of two values is approximately the relative change in the value, we can interpret *SDRER* as the real exchange rate's average relative deviation from its mean. To make it clearer; a one unit increase in *SDRER* means that the real exchange rate's average relative deviation from its mean increases by 100 percentage points. The estimate tells us that an increase in the standard deviation of the real exchange rate by 1 is associated with a 6.9 percentage point decrease in the average growth rate.[10] Or put differently, that an increase in the real exchange rate's average relative deviation from its mean by 10 percentage points is associated with a 0.69 percentage points drop in growth rate. Taken into account that 95 percent of the observations in my sample has a value of *SDRER* of 0.36 or below (the values range from 0.01 to 3.95[11]), a change of 0.1 is quite a large change. But for countries with very high real exchange rate volatility, there might be a lot to gain from reducing this volatility, if the point estimate should be taken seriously.

With regard to the theory discussed in chapter 2, one of the most interesting findings is that when the investment rate is controlled for, macroeconomic stability seems to matter for economic growth, but it is far less clear that it matters for investments. I will discuss possible explanations for this in chapter 6.

5.1 Replication of Bleaney (1996)

In this section I will use the same method and the same countries as Bleaney (1996), but not all my data are from the same sources as his. As mentioned in chapter 4, Bleaney uses the foreign debt of the central government as percentage of exports whereas I use the total central government debt as percentage of GDP. Other than that, all variables are constructed in the same way.

The estimated coefficients on the control variables are, with one exception, very similar to those of Bleaney (1996):

$$GR = \underset{(1.52)}{0.0472} - \underset{(-2.52)}{0.941}LGR + \underset{(4.68)}{0.283}INV + \underset{(1.43)}{0.114}XYGR - \underset{(-2.61)}{0.00963}LYPC79$$

Figures in parenthesis are t-statistics. The variables are the same as above

The coefficient estimate of the impact of population growth on per capita GDP growth, is considerably larger here than in Bleaney (1996). I have tried population data from several different databases[12] and they all yield more or less the same result. Given that the other coefficient estimates are similar to the ones in Bleaney (1996), the most plausible explanation is that he had poor data on population growth.[13]

[10] The rates are expressed in decimals, so the coefficient of *SDRER* must be multiplied by 100.
[11] There are only two observations in my sample with values of *SDRER* above one. Excluding these from the sample has no significant effect on any of the estimates.
[12] The World Bank's WDI, IMF's IFS and Penn World Table.
[13] I have been in touch with Prof. Bleaney, and he confirms that I have constructed the variables correctly, but he no longer has the dataset, so it is hard to find out what causes this difference.

Tab. 3: OLS same countries as Bleaney 1980-1990

	(1) GR	(2) GR	(3) GR	(4) INV	(5) INV	(6) INV
BS	0.210**	0.211**		0.257	0.314	0.325
	(2.46)	(2.44)		(1.12)	(1.35)	(1.44)
SDRER	-0.0868**	-0.0701*		-0.0941	-0.0104	-0.0887
	(-2.44)	(-1.84)		(-0.99)	(-0.10)	(-1.04)
CPinf	0.00195	0.00417		-0.00801	0.00362	
	(0.16)	(0.32)		(-0.26)	(0.11)	
debtX9	-0.00270			-0.0118*		
	(-1.04)			(-1.70)		
HIC		-0.00458			-0.0286	
		(-0.56)			(-1.31)	
INV*BS			0.826***			
			(2.80)			
INV*SDRER			-0.392**			
			(-2.60)			
INV*CPinf			-0.00578			
			(-0.10)			
INV*debtX9			-0.0165			
			(-1.20)			
F-statistic	2.750	2.501	3.552	1.363	1.052	1.181
p-value	0.0451	0.0620	0.0166	0.269	0.396	0.319
N	41	41	41	40	40	40

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

GR, INV, BS, SDRER, CPinf and HIC are as described above, while debtX9 is the ratio of central government debt to GDP in 1979. F-statistic is a test of the hypothesis that coefficients of regressors shown are jointly zero, while "p-value" is the corresponding p-value.

The results for the variables of interest are shown in Tab. 3. I will only briefly comment on the differences between mine and Bleaney's results in this section. Focusing first on the growth regressions (columns (1)-(3)), the coefficient estimates and t-values are slightly higher for *BS* and *INVxBS* in my regressions than in Bleaney (1996). The estimates for the coefficient of *SDRER* are similar to Bleaney (1996), at least in column (2). The estimates for *CPinf*, *debt79* and *HIC* are close to zero, and have such large standard errors in both the replication and in Bleaney (1996) that it is hard to compare their values.

When looking at the investment regressions (columns (4)-(6)), the standard errors are so large that it is hard to compare the point estimates, except for the coefficient estimates of *BS* and *HIC*. The estimate of the budget surplus coefficient is more or less the same, while the *HIC* coefficient estimate is much lower in the replication than in Bleaney (1996).

By looking at the joint significance tests, we see the same observation as in Bleaney (1996), namely that it seems like there is a relationship between the indicators of macroeconomic stability and per capita GDP growth, but there is no evidence that there is a relationship between these indicators and the investment rate.

5.2 Adding more countries, and looking at the 1990s and 2000s

In this first step of the extended analysis I added more countries, to see if the results change when the sample is expanded. In this section I have included all developing countries for which there was sufficient available data. The variables *BS*, *CPinf* and *debtX9* were the critical ones with respect to data availability. Data on initial central government debt is only observed once per decade, so it is either available or not, but *BS* and *CPinf* are decade averages. In cases where there were only a few observations of these variables, the decade mean would be very inaccurate. However, if I only used the countries where I had available data for the whole decade, I would be left with too few observations. I therefore chose to drop the observation if there were more than three missing observations for those variables in a decade.[14] A list of included countries in the different regressions of this section can be found in Tab. 10 in *Appendix B*.

Tab. 4: Three separate OLS regressions for 1980s (1) 1990s (2) and 2000s (3), and pooled OLS for 1980-2009 (4)

	(1) GR	(2) GR	(3) GR	(4) GR
BS	0.171*	0.112	-0.0289	0.111**
	(2.02)	(1.24)	(-0.33)	(2.36)
SDRER	-0.00540	-0.0224	0.0187	-0.00448
	(-0.80)	(-0.72)	(1.28)	(-0.95)
CPinf	-0.00437	-0.00798	-0.0326	-0.0133**
	(-0.35)	(-0.79)	(-1.44)	(-2.00)
debtX9	-0.00563	0.000779	0.000436	-0.00119
	(-0.41)	(0.15)	(0.11)	(-0.40)
F-statistic	3.081	0.658	0.683	4.224
p-value	0.0283	0.625	0.606	0.00284
N	44	52	70	166

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Estimates of the coefficients of the control variables can be found in Tab. 8.

[14] Therefore Belize, Dominican Republic and Tunisia were not included in the regression reported in Tab. 4 (1), even though they were included in the previous section.

The results for the years 1980-89 are shown in Tab. 4 (1). We see two noticeable differences between this and the results in the previous section. The coefficient of BS is somewhat lower, and the coefficient of $SDRER$ is much lower and insignificant. I will investigate this result further in section 6.1. The coefficients for inflation and initial government debt remain low and insignificant. What is also worth noticing is that the hypothesis that all of them are zero is rejected at a very low level of significance (p-value of 0.02). This strengthens the hypothesis that macroeconomic stability matters for growth.

When looking at the results for the 1990s (column (2)), we see that the coefficient of the budget surplus is even lower and insignificant. None of the variables seems to be significant alone, and even the joint significance test cannot reject the hypothesis that all coefficients are zero.

The results for the 2000s in column (3) differ from the 1980s in many interesting aspects. Firstly the estimate of the coefficient of the inflation rate is notably larger (in absolute value) and its t-value is also higher. Secondly the coefficient of *SDRER* is positive, which is the opposite of what we would expect from theory, but still statistically insignificant. The coefficient estimate of the budget surplus is very close to zero (even negative) and statistically insignificant. Why this estimate differs so much from the others will also be discussed in section 6.1. To test if any of the coefficient estimates for the 1990s and 2000s were significantly different from the estimates for the 1980s, I ran a pooled OLS regression with dummies for the 1990s and 2000s multiplied with each of the regressors. The results showed that none of the estimates were significantly different from each other at a five percent significance level. Another thing worth noticing is that the joint hypothesis test does not reject the hypothesis that all coefficients equal zero.

Column (4) shows the results from a pooled OLS regression, with dummies for the 1990s and 2000s, to control for time trends. The coefficient of the inflation rate is negative and significant at a five percent level, but the impact seems to be very small. The coefficient of the budget surplus is lower than in the 1980s regression, but still statistically significant. I will come back to discussing this finding in section 6.1. What is also worth noticing is that although the joint significance tests for the 1990s and 2000s do not reject the hypothesis that all coefficients are zero, it is rejected at a very low significance for the pooled OLS regression.

In this section I have expanded the analyses of section 5.1 and in Bleaney (1996) and looked at each decade separately. I have not taken advantage of the panel structure of the data, in order to control for time constant country specific effects. This is the topic for the next section.

5.3 Panel regression

To be able to control for time constant country fixed effects like institutional quality or cultural differences, I ran fixed effects panel regressions. The results of these regressions are shown in Tab. 5. There are several interesting things

Tab. 5: GDP per capita growth and investment on indicators of macroeconomic stability (panel regression)

	(1) GR	(2) GR	(3) GR	(4) INV	(5) INV
BS	0.0202	0.0435		0.371	0.309
	(0.27)	(0.52)		(1.37)	(1.22)
SDRER	-0.00316	-0.00328		-0.00339	-0.000919
	(-0.55)	(-0.57)		(-0.16)	(-0.05)
CPinf	-0.0272***	-0.0202**		0.00402	-0.00716
	(-3.12)	(-2.03)		(0.12)	(-0.24)
debtX9		-0.00974*		-0.0142	
		(-1.84)		(-0.83)	
INV*BS			0.125		
			(0.36)		
INV*SDRER			-0.0137		
			(-0.52)		
INV*CPinf			-0.117**		
			(-2.41)		
INV*DEBTX9			-0.0469**		
			(-2.00)		
F-statistic	5.134	3.076	3.727	0.736	0.720
p-value	0.00275	0.0217	0.00842	0.570	0.543
N	174	166	166	164	170

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Estimates of the coefficients of the control variables can be found in Tab. 9.

worth noticing about the results of the growth regressions (column (1)-(3)). In the growth regressions, the central government budget surplus seems to have no effect on growth. The coefficient estimates are close to zero, and so are the t-values. This is in stark contrast to the findings of Bleaney (1996), where the budget surplus seems to be the most significant variable. The estimate of real exchange rate volatility coefficient is close to zero and insignificant. This is also very different from the results in Bleaney (1996), where it appeared as statistically significant and of a size that suggested an economically significant impact on the growth rate, at least for countries with high real exchange rate volatility.

The inflation rate appears as statistically significant, with a coefficient estimate of around -0.02 (in column (2)). This tells us that an increase in the inflation rate by one percentage point is associated with a 0.02 percentage points decrease in the growth rate. Or equivalently that a decrease in the inflation rate by 10 percentage points is associated with a 0.2 percentage points increase in growth rate. This is much higher than the estimates in Bleaney (1996), but it is still not enough to be regarded as economically significant.

While the government debt to GDP ratio seems to be statistically significant at a 10 percent significance level, the coefficient estimate is so small that it can be regarded as economically insignificant.

In Bleaney (1996) and in section 5.1, the specification where the Z variables are multiplied with the investment rate (3) fits the data marginally better (the F-values are higher). Bleaney interprets this as an indication that "the impact of macroeconomic instability falls mainly on the quality of the capital stock" (Bleaney, 1996, p. 471). By the quality of an investment, he means the return to the investment. A more stable macroeconomic environment makes it easier to predict future demand and future earnings, thus it is more likely that the investment will ensure an allocation of resources that maximizes the value of production. The results in section 5.1 indicate the same, but this is far less clear in the panel regression.

When looking at the investment regressions in the two last columns of Tab. 5, we see that the only variable that is somewhere close to significant is the central government budget surplus as percentage of GDP. It is important to keep in mind that budget deficits need to be financed through borrowing. The negative effect that budget deficits (maybe) have on the investment rate, might therefore be a result of a crowding out effect (see chapter 2).

Before moving on to discussing these findings, it is worth taking a look at the joint significance tests. By looking at the F-statistics for the growth regressions, we see that the hypothesis that the coefficients of all the regressors of interest are zero is rejected at every reasonable level of significance. However, this is not the case for the investment regressions. This is the same result as in Bleaney (1996), and can be interpreted to strengthen the hypothesis that macroeconomic stability affects growth through other channels than the investment channel. Although the evidence for statistical significance seems very strong, none of the indicators of macroeconomic stability seem to have an impact on growth that is large enough to be regarded as economically significant.

6. DISCUSSION

After expanding Bleaney's (1996) analysis, first by adding more observations and then by performing a panel regression, there are a few interesting findings that deserve some discussion. I will keep the discussion mainly to the growth regressions, since the investment regressions do not differ that much and since I do not have enough control variables in those regressions for the results to be very reliable.

To start at the general level, the *joint significance tests* indicate that there is a relationship between the indicators of macroeconomic (mis)management and growth. In the panel regression, the hypothesis that all the coefficients of the Z variables are zero, is rejected at every reasonable level of significance. This is confirmed in section 5.2 by looking at the regression for the 1980s and the pooled OLS regression. However, it is not rejected in the regressions for the 1990s and the 2000s.

A second interesting finding is that the coefficient of the *budget surplus*, which is relatively large and significant in the 1980s regression, is very low and insignificant in the OLS regressions for the other decades as well as in the panel regression. It turns out that this can probably be explained by the fact that *one single outlier* with extraordinary high values on both budget surplus and growth in the 1980s is responsible for the size and significance of the coefficient. I will look into the issue of outliers in section 6.1.

A third thing worth noticing is that the *coefficient on inflation* has the expected sign in all specifications in the panel regression. It is also alot larger than in Bleaney (1996), and it is significant on a five percent level. This might be interpreted as an argument in favour of the hypothesis that high inflation inhibits growth, but it might also be a result of a spurious effect, as I will discuss in section 6.2. Although it is statistically significant, it does not seem to be economically significant. However, this might be a result of the way the equation is specified. I will look further into this in section 6.3.

Also the *initial government debt* as percentage of GDP seems to be negatively associated with economic growth, but the estimated coefficient is so low that huge reductions in the debt level are associated with very small improvements in the growth rate. As with the investment rate, this might also be a result of the specification of the equation (see section 6.3).

After this extended analysis it is a somewhat confusing result that remains. When looking at the results from the panel regression (Tab. 5), the statistical significance is stronger than what was demonstrated in Bleaney (1996), but the economic significance is weaker. The results from the panel regression strongly support the hypothesis that there exists a relationship between macroeconomic stability and growth, yet the size of the coefficients are so small that it seems like very large improvements in the indicators of macroeconomic stability are associated with small increases in growth rates. The main reason for this is that the results from the panel regression do not support the hypothesis that a lower budget deficit is associated with a higher growth rate. Nor do they support the hypothesis that real exchange rate volatility inhibits growth. These were the most significant (statistically and economic) variables in Bleaney's analysis. The only two Z variables that appear to be associated with growth are the inflation rate and the initial government debt. And though they seem to be statistically significant, it seems like their impact on growth is so small that even large improvements in these are associated with moderate improvements in growth rate, but as mentioned, this may be a result of how the model is specified.

Before I discuss potential problems with the results in the panel regression I will discuss the concept of outliers, and look into how single outliers are driving the results in Bleaney (1996), and can explain some of the differences between the result in the panel regression and the cross section regressions in section 5.1.

6.1 Outliers

An outlier is an observation that does not seem to follow the pattern of the other data points. When doing OLS regressions with small samples, one has to be aware of the effect an outlier has on the estimates. The same is true for true for panel regressions, since it is only a modified form of OLS. The danger is that the outlier causes a bias in the coefficient estimate:

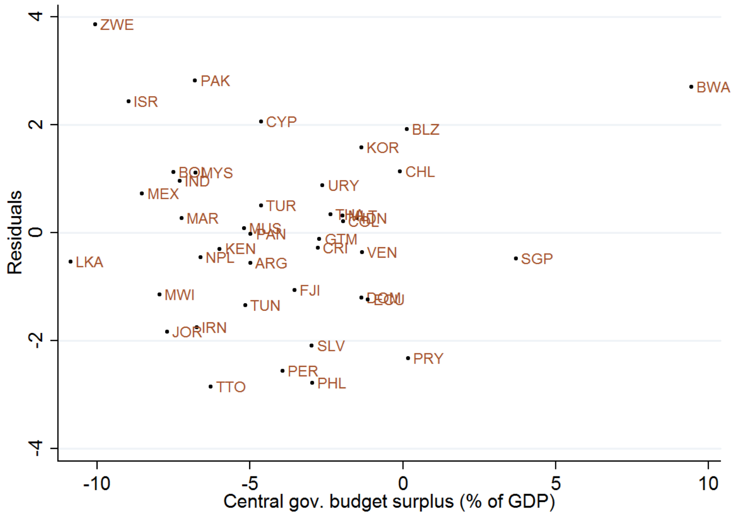
> [A] large error when squared becomes very large, so when minimizing the sum of squared errors OLS gives a high weight to this observation, causing the OLS estimating line to swing towards this observation, masking the fact that it is an outlier.
> (Kennedy, 2009, p. 346).

This problem will be especially severe in small samples, like the ones used in this paper.

To investigate whether there are outliers that are causing large biases in my results the first task would be to identify the outliers. To do this for the OLS regressions, I plotted the estimated residuals against each variable of interest, to see if any of the observation differed much from the others. As shown in Fig. 3, there is one country that has an average government budget surplus way above the other countries, that also has a high estimated residual, namely Botswana.

The next step would be to run the regression again without Botswana in the sample. The results of this regression are shown in Tab. 6 (1). As we see, the estimate of the coefficient of the budget surplus is less than half of what it was in Tab. 3, and it is no longer significant. The same happens in

Fig. 3: Botswana as an outlier in the Bleaney (1996) replication



the pooled OLS regression (in Tab. 4) when Botswana is excluded. This is a clear indication that the result Bleaney (1996) found with respect to this variable is not very robust.

Tab. 6: Coefficient estimates after excluding outliers

	(1) GR	(2) GR
BS	0.0918	0.205**
	(0.87)	(2.51)
SDRER	-0.0723**	-0.0369
	(-2.05)	(-0.89)
CPinf	-0.00374	-0.0165
	(-0.30)	(-1.11)
debtX9	-0.00266	-0.00250
	(-1.06)	(-1.01)
F-statistic	1.743	3.186
p-value	0.166	0.0265
N	40	40

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
(1) shows how the results from the Bleaney (1996) replication (Tab 3 (1)) change when Botswana is excluded, while (2) shows how the results change when Israel is excluded.

What is so special about Botswana? In the early 1970s the South African company De Beers discovered diamonds in northern Botswana. In 1975, when the government discovered how productive the diamond mines were, they managed to negotiate a mining agreement with De Beers that gave the government a 50 percent share of diamond profits. The discovery of diamonds have been driving economic growth in Botswana since then, and is one of the reasons why Botswana has been among the fastest growing countries for the last 40 years. Due to the mining deal it has also contributed to giving the government high budget surpluses (Acemoglu et al., 2002).

This is a clear example of an omitted variable (the presence of diamonds) that affects both the budget surplus and the growth rate, and causes a bias in the estimates. It also demonstrates how vulnerable regressions with few observations are to outliers like Botswana.

Looking at the residual plots may be a subjective way of finding potential outliers. It may also be hard to spot them, because the process of minimizing squared residuals makes sure that the residuals are not so large. A more systematic way of investigating this problem, is to run the regression n times where observation i is excluded from the sample, one at a time (Kennedy, 2009, p. 346–347). I used this method to control for outliers in all of the regressions in chapter 5. In addition to Botswana's effect on the coefficient of the budget surplus, there was one other country that seemed to have a severe impact on an estimate, namely Israel. When Israel was excluded from the sample, the coefficient of *SDRER* became much smaller and insignificant (see Tab. 6 (2)).

Israel had a relatively stable real exchange rate in the 1980s despite very high inflation in the start of the decade. They had a relatively low investment rate, high initial GDP per capita and a negative growth in the exports/GDP ratio. These are all factors that are associated with a low growth rate in my regressions, yet Israel had an average annual growth rate of 2 percent for the years 1980-1990. An explanation to why Israel seems to be driving the result can be that it scores high on some omitted variable, like institutional quality, that contributes to a higher growth rate, but since it also had a stable real exchange rate it becomes an outlier that biases the estimate of the coefficient of *SDRER*.

We have seen that excluding some outliers may change the results dramatically. But are these results more reliable than the ones where the outliers are included? If the reason the outlier observations are outliers is because of measurement errors, the answer is clearly yes. If not, then it is less clear what to do about them (Kennedy, 2009, p. 346–347). They may be outliers because they simply do not fit the model. So excluding them would make the model fit better to the data. However I will argue that this is not likely to be the case here.

Excluding Botswana in the Bleaney (1996) replication does not make the model fit the data better. On the contrary, we see that this single observation was the reason why the budget surplus coefficient seemed to be statistically significant. The same can be said about Israel and the real exchange rate volatility coefficient.

The fact that the results for *BS* and *SDRER* are so sensitive to one single observation casts doubt on the robustness of the result. The observation that when including more data and controlling for country fixed effect, the estimates turns out as insignificant, shows that we have good reason to doubt these findings in Bleaney (1996).

The fact that the effect of the budget surplus disappeared when going from a pooled OLS regression to a fixed effects panel regression also highlights the difference between these two estimation methods. While the pooled OLS estimates suffer from an omitted variable bias, the fixed effects method corrects for the biases of time constant country specific effects like diamond production.

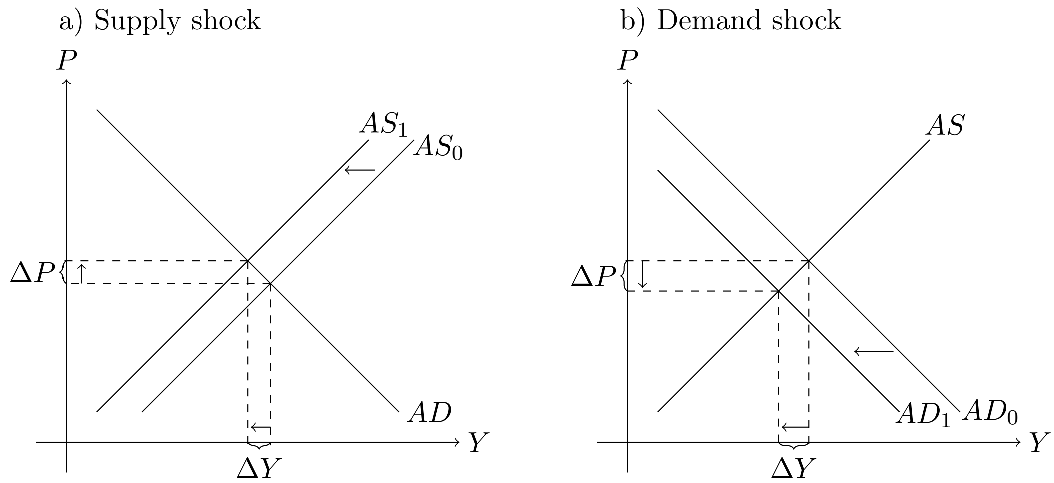
This is not to conclude that a viable fiscal policy and stability in the real exchange rate has no impact on growth, but that there is no econometric evidence that it does. I will discuss why there might be effects that we are unable to detect in section 6.5.

6.2 Endogeneity problems

One of the most serious problems about growth regressions that use macro variables as regressors, like the ones in this paper, is that the exogeneity assumption underlying the analysis is unlikely to hold. It is not hard to argue that almost all of the regressors I have used depend on omitted variables that also affect growth, or that they depend on growth themselves. The list of omitted variables that might have caused biases or explanations to why the variables are subject to reverse causality is long, and I will not attempt to list all of them here. However, I will discuss some of the most obvious candidates and try to asses how likely it is that my estimates are biased by them.

I will start by focusing on a possible omitted variable bias that affects the coefficient of the inflation rate. According to Fischer (1993, p. 489), a negative supply shock will cause both GDP and inflation to fall. The reasoning behind this argument is an AS-AD model, where supply and demand depend on the price level. As shown in figure 4 (a), a negative supply shock will cause

Fig. 4: Negative supply and demand shocks in an AS-AD model



an inward shift in the aggregate supply curve, and thus cause a contraction in GDP and an increase in the price level. However, a negative demand shock would cause a contraction in GDP and a decrease in the price level (see Fig. 4 (b)). If these kinds of shocks have large impacts on 10 year average growth and inflation rates, which way they bias the coefficient depend on whether supply shocks or demand shocks are most common. If demand shocks are most common, it might be that my estimate on the coefficient of the inflation rate is upward biased (too low in absolute value). However, unless these shocks are very large and persistent, it is not very likely that they contribute to any large biases.

Due to the way the real exchange variable is constructed ($R = \frac{P^*E}{P}$) a high inflation rate will automatically cause the real exchange rate to appreciate. This might be offset by a nominal depreciation, but in practice (at least in my dataset) we see that the correlation between inflation rate and real exchange rate volatility is high, which is an indication that these usually do not perfectly offset each other. This means that if the presence of supply or demand shocks biase the coefficient estimates of the inflation rate, it will also bias the *SDRER* coefficient estimate. While positive and negative shocks have opposite effects on the growth rate, they will both contribute to a higher exchange rate volatility. Hence, whether it is upward or downward biased depends on whether positive or negative supply and demand shocks are most common. However, since the coefficient estimate is so low and insignificant, I will not spend more time discussing this possibility.

The *government debt to GDP ratio* will naturally depend on the size of GDP and thus the growth rate. This is the reason why I have used the initial level, meaning the year before the decade started. There is no way that growth in the 1980s could affect the ratio of government debt to GDP in 1979. However, a low growth rate in the 1970s may have contributed to a large debt to GDP ratio in 1979. This is both because it contributes to a lower GDP in 1979, because the low growth may have generated less income for the government and thus led to larger budget deficits and because countries with low growth faced higher interest rates because of higher default risk. If there was some variable that reduced growth in the 1970s that also had the same effect on growth in the 1980s, this variable indirectly caused a high initial debt to GDP ratio as well as low growth in the 1980s. However, such a variable should be persistent over time, and these kinds of variables are controlled for in the fixed effect panel regressions.

The *central government budget surplus* is likely to be high in years of economic expansion and low in years of economic contraction. Including this variable in a growth regression should therefore be done with great care. The argument for exogeneity to hold is that we are looking at 10 year averages, and that cyclical effects will be canceled out over this period. However, as we have seen in the case of Botswana, there might be omitted variables that cause high growth for more than a decade and gives the government additional income which causes high budget surpluses. Also here, we would expect such a variable to be relatively persistent over time, so this problem will be smaller in a fixed effect panel regression than in the cross country regression. The fact that the budget surplus seems to be insignificant in the panel regression, even though Botswana is included, is a good example of this.

6.3 Specification

The results from the panel regression indicate that the investment rate and the initial level of government debt are significantly correlated to the growth rate, but that the impact is so low that even very large improvements on these will have small effects on the growth rate. However, it might be too soon to conclude that these two variables have no economically significant impact on growth. One possibility is that government debt and inflation have no impact on growth as long as they are at moderate levels, but when they cross a threshold it becomes detrimental to economic growth.

Reinhart and Rogoff (2010) showed that government debt have no significant impact on growth until it reaches 90 percent of GDP. Above this threshold, there is a sharp drop in growth rates.[15] A reasoning behind this may be that it is only when the debt reaches a certain level that the actors perceive it as unsustainable, and they realize that the government may be unable to repay.

A similar argument can be made with respect to the inflation rate: At moderate levels of inflation there is certainty about future price levels, and it might not have any impact on economic growth. It is only when the inflation rate reaches a certain level that it becomes detrimental to growth. It is also possible to argue that as long as it is above this level it does not matter how high the inflation is, because above this threshold the price as an information mechanism has ceased to function.

To check if a threshold model, where debt and inflation has no impact at moderate levels, but has a negative impact on growth when it reaches a certain level, I generated dummy variables. One dummy that equals one if the initial government debt to GDP ratio is above 90 percent and zero otherwise and one that equals one if the average rate of inflation is above 25 percent and zero otherwise. These were included in the panel regression instead of the original inflation and debt variables.

Of the 166 observations there were 20 that had initial government debt level above 90 percent of GDP, their per capita GDP growth rate averaged 1.7 percent, while the 146 observations that had initial government debt of less than 90 percent had an average growth rate of 2.5 percent. There were 20 observations with average inflation above 25 percent. Their average annual growth rate was 0.7 percent, while the average growth rate for the 146 observations with moderate inflation rates was 2.6 percent. For the rest of the

[15] Thomas Herndon, Michael Ash and Robert Pollin of the University of Massachusetts discovered a coding error in the excel spreadsheet of Reinhart and Rogoff (2010) that caused these results to be biased. However, Reinhart and Rogoff argue that this was just one of several calculations, and that their main result still holds (The Economist, 2013).

Tab. 7: Dummies for high debt and inflation (in the panel regression)

	(1) GR	(2) INV	(3) GR
BS	0.0189	0.349	0.0249
	(0.24)	(1.31)	(0.30)
SDRER	-0.00315	-0.00177	-0.00336
	(-0.58)	(-0.09)	(-0.60)
Hinf	-0.0194***	-0.00100	-0.0209*
	(-3.01)	(-0.04)	(-1.86)
Hdebt	-0.0157**	-0.0271	-0.0136
	(-2.37)	(-1.17)	(-1.36)
CPinf			0.00296
			(0.18)
debtX9			-0.00207
			(-0.27)
F-statistic	5.102	0.916	3.320
p-value	0.00118	0.460	0.00643
N	166	164	166

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
(1) and (2) shows the results from Tab. 5 (2) and (4), respectively, when *CPinf* and *debtX9* are replaced with the following dummies: *Hinf*, that equals 1 if average inflation rate is above 25 percent and 0 otherwise. And *Hdebt*, that equals 1 if the initial government debt to GDP ratio is above 90 percent and 0 otherwise. (3) shows the results of the same regression as (1) when the original variables are included in addition to the dummies.

section I will refer to an inflation level of below 25 percent as moderate, and as high if it is above this level. Similarly I will refer to the government debt level as sustainable if it is below 90 percent, and unsustainable if it is above this level. This is not to say that I believe that there exists sharp thresholds like these. At what level a government's debt is sustainable or what a moderate inflation rate is, depends on many different circumstances, and probably differs between countries and time periods. These labels are simplifications to make the discussion easier to follow.

The results of the growth and investment regressions are shown in Tab. 7. The estimates from the panel regression indicate that the impact of debt and inflation is higher than it seemed in section 5.3. We see that going from a moderate to a high inflation is associated with a drop in average annual growth rate of around two percentage points, while going from a sustainable level of government debt to an unsustainable level is associated with a drop in the growth rate of around 1.6 percentage points. Their t-values are higher than in Tab. 5, which indicates that the new specification fits better to the data than the old one.

If this threshold specification is a good approximation to reality, we would expect the effect of the original variables to disappear when they are included in the regression, together with the dummies. The results when both the dummies and their original variables are included in the regression are shown in column (3). None of them are significant at a five percent level, but the t-values of *CPinf* and *debtX9* are close to zero, while the t-values of *Hinf* and *Hdebt* are -1.86 and -1.36 respectively. The coefficient estimates are roughly the same for the dummies as in column (1), while they are close to zero for the original variables. This indicates that the threshold model fits the data fairly well, but that collinearity problems make the standard errors large.

In the investment regression (see column (2)), it still seems like none of the variables have any significant impact on investment. Even though it is not statistically significant, the coefficient estimate of the government budget balance does indicate that there might be an effect. As discussed earlier this is not necessarily an indication that macroeconomic instability is associated with a lower investment rate, but rather that government borrowing causes investments to shift from real capital to government bonds (crowding out). It is also worth noticing that the t-value of the debt coefficient is higher than in the original regression, though it is still insignificant.

The evidence indicates that rather than being a linear relationship between these variables and growth, there are sustainable and unsustainable levels of debt and inflation, and crossing these thresholds is what inhibits growth. If this is so, and the estimates can be trusted, this changes the conclusion that these variables have an economically insignificant impact on growth. We have to be careful when interpreting these point estimates, because there are large standard errors, but effects of 1.6 and 2 percentage point changes in average annual growth rates are pretty extraordinary. However, this is not necessarily an indication that macroeconomic instability is very detrimental to growth. It only tells us that very high inflation and initial government debt are negatively associated with economic growth. I therefore find it more useful to look at each one of these variables individually in order to assess the possible mechanisms at work.

6.4 Mechanisms

In chapter 2, I presented theories that explain how macroeconomic instability can influence growth. On the general level, the theories predict that macroeconomic stability inhibits growth through causing a lower level of investments. I find no evidence that macroeconomic instability in general, as measured by all the indicators, affect the level of investments. I therefore find it little relevant to focus on this mechanism here, and prefer to look at the indicators identified as significant separately, when discussing possible mechanisms through which they can affect growth.

While Bleaney's (1996) analysis indicated that the central government budget surplus and the real exchange rate volatility were the variables that were most closely related to growth, the results from the panel regression suggests that the inflation rate and initial debt level were the ones related to the growth rate. Bleaney's result could possibly be explained by the crowding out effect budget deficits have on investments in productive capital (see section 2.1), and by the effect that real exchange rate volatility can have on development of industrial clusters (see section 2.4). However, my results and the results of the Bleaney (1996) replication after excluding outliers indicate that his results are not very robust. I will therefore focus the discussion in this section on possible mechanisms at work that causes high initial government debt and high inflation to be detrimental to economic growth.

Due to lack of easily available data, I have not been able to test if there is any evidence of the mechanisms I suggest. However, I have chosen to present them to show that a causal relationship between these variables (high initial government debt and high inflation) and growth may exist, and give the reader an idea of the possible mechanisms at work.

6.4.1 Debt overhang

When a country's public debt is at a level where investors realize that it is unlikely that the country will be able to repay it, we would expect investors to be very reluctant to buy government bonds from that country. This will seriously limit the government's access to credit and make it hard to finance even projects that would have yielded great returns. This means that we can expect investments that are typically done by the government, like investments in infrastructure, health and education, to be lower if the country suffers from a debt overhang. Another reason why countries with high debt levels have less to spend on good investments is that they have to use a larger share of their available resources on debt repayment.

It is also possible that this might affect private investment as well. As we have seen in the recent financial crisis, when the government bond loses its value, domestic banks that hold many of these bonds will have problems getting access to credit themselves, which again will affect the credit access for domestic firms. Another possibility is that investors realize that the government has to increase taxes in the future in order to reduce the debt level. Since they do not know which taxes they will increase, it increases the risk of new investments, and thus has a negative impact on the investment rate.

Although there is no conclusive evidence that the initial debt level is associated with the investment rate, this should not be interpreted as evidence that such a relationship does not exist. Due to lack of good control variables, the standard errors of the estimates in all the investment regressions are so large that none of the regressors (including the control variables) are significant at a five percent level. Due to lack of data on public investments, I have not been able to test whether high initial government debt is associated with a lower level of public investments.

An interesting observation is that while high budget deficits are not associated with lower growth, it will normally contribute to increasing government debt, which in turn will have a negative impact on growth in the future.

6.4.2 High inflation

While the estimate of the coefficient of the high inflation dummy in the growth regression is large and significant at every reasonable significance level, this is not the case in the investment regression. This can be interpreted as evidence that a high inflation rate affects growth through other channels than the investment rate. One possibility is that high inflation is bad for the quality of investments (Bleaney, 1996). Another possibility is that it distorts relative prices and inhibits an efficient allocation of resources (Fischer, 1983).

As mentioned earlier the level and volatility of the inflation rate are so highly correlated that it is practically impossible to distinguish one from the other, especially because I only have yearly data. In addition to uncertainty about future price levels, there is also reason to believe that high inflation distorts relative prices. Tommasi (1992) showed that inflation in Argentina also was associated with instability in relative prices, and Fischer et al. (1981) showed that unanticipated monetary shocks are related to distortions in relative prices.

With this in mind we can think of two main reasons why the quality of investments should be affected by the level of inflation. The first is that demand depends on the general price level, at least in a world with sticky wages, and when future price level is uncertain it is hard to calculate future demand. When uncertainty about demand is high, the likelihood of making an investment that does not yield high return is also high. The second reason is that firms may plan to use a combination of inputs that seemed rational according to their expectations of relative prices, but the relative prices may turn out to be different from what they expected when they planned the production. In addition to difficulties in planning the use of inputs, the relative price level is also an important factor in determining demand for the product the firm is producing. Therefore even though investments are made, they do not generate growth because the investors fail to foresee future demand and future relative prices. However, I find it unlikely that the inflation rate has such a large effect on the quality of investments when there does not seem to be any effect on the investment rate.

High inflation also reduces the efficiency of the price mechanism, and thus causes an inefficient allocation of resources that in turn reduces the total factor productivity (Fischer, 1993). Especially in cases where reallocation of resources plays an important role in the growth process, high inflation disturbs this reallocation and thus inhibits growth.

This problem will be especially severe in times of extreme inflation. It is often seen that inflation crises cause collapses of the economy (Capie, 1991). Although these crises are short and the economy recovers quickly after the crisis, it might be enough to have a significant impact on the 10 year average growth rate. Bruno and Easterly (1998) find no significant effects of inflation on growth in the cross section regression with 30 year averages. They show that periods of inflation crisis (inflation rate above 40 percent) are associated with periods of negative growth, but that growth quickly recovers after the inflation is down to moderate levels again. They also argue that the growth following the end of an inflation crisis is so high that it "cancels out some – or possibly all – of the output lost during the high inflation crisis" (Bruno and Easterly, 1998, p. 4).

By looking at the raw data, it seems like years with very high inflation are associated with negative growth, but there is no clear sign of a quick and strong recovery: If I define an inflation crisis as a period with inflation above 100 percent, the average length of the crisis in my sample is 3.35 years, the average growth rate in crisis years was -3.9 percent and the average growth rate the year after the crisis was 0.7 percent (the average growth rate in my sample is 2.2 percent).

These numbers show that it is absolutely plausible that the association between high inflation and low growth might be a result of economic contractions during periods of high inflation, and that these are not compensated for by strong recoveries.

6.5 Heterogeneous effects

Economic growth occurs in different countries for different reasons. There is no single policy, institution or culture that promotes growth independent of the circumstances in which they exist. Even though country specific effects are controlled for in the panel regressions, I do not control for how different circumstances in each country interact with the variables of interest. This is hard to do because it is hard to know what these circumstances are, and how to measure them. Hence, it is only the variables that have more or less the same effect in most of the countries that will appear as significant in this type of regressions.

As mentioned in section 2.4, a stable real exchange rate is only one condition that has to be fulfilled in order for industrial clusters to develop. There are probably many more conditions that must be in place for this to happen, which I do not control for. In addition, development of industrial clusters may be one way of generating economic growth in a country, but there are many other reasons why growth can occur.

Unless very clever ways of controlling for complex interactions between variables that can hardly be measured, quantitative empirical research can only tell us so much about what generates economic growth. This is not to say we should stop doing it, but our conclusions should be drawn with care, and we should combine quantitative methods with qualitative analysis of historical events. However, this thesis is only a small contribution in the debate, and I have therefore chosen to focus on the quantitative analysis, rather than looking into historical examples.

7. CONCLUSION

The purpose of this thesis was to investigate to which extent the results Bleaney (1996) found hold when additional data is used and when country fixed effects are controlled for. I have shown that there are several weaknesses with his analysis that causes biases in his results. Since he does not control for country specific factors that might affect both the regressors and growth, his estimates of the coefficients of the budget balance and real exchange rate volatility are respectively upward and downward biased. In combination with a small sample, in which outliers have a great impact on the estimates, this leads him to greatly overstate the effect that these variables have on economic growth.

Of the four indicators of macroeconomic instability included in this thesis, only the inflation rate and the initial government debt level seem to be significantly associated with economic growth. In the first fixed effect regression analysis it seems like the effect of these two variables were economically insignificant. However, this seems to be a result of the way the equation was specified. By using dummy variables for high inflation and high initial government debt, I showed that a threshold model fits the data better than the linear effects model. I find evidence that initial government debt and inflation rates have no impact on growth rate as long as they are at moderate levels, but when they reach levels that can be regarded as unsustainable, the negative impact on growth is substantial.

I argue that high initial debt levels make it impossible for governments to get access to new loans, and that this has adverse effect on productivity enhancing public – and possibly also private – investments. I also argue that the explanation of the association between high inflation and growth is that inflation crises cause economic collapses that are not neutralized by quick recoveries.

While I find no econometric evidence that the budget surplus and real exchange rate affects growth, there is no reason to conclude that they do not matter for growth. I argue the effect that these, and many other, variables have on economic growth are dependent on the circumstances in which they operate. It is therefore hard to measure them in normal regression analysis. To get guidance on which policies to pursue, one has to combine traditional econometric analysis with economic theory and qualitative analysis of historical events.

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Appendix A

VARIABLE DESCRIPTIONS AND DATA SOURCES

GR - Growth in GDP per capita. Data is from the World Bank's *International Development Indicators* database. Where data was not available, I used data from IMF's *International Financial Statistics* database (IFS).

Lgr - Population growth. Data is from the World Bank's *International Development Indicators* database. Where data was not available, I used data from IMF's *International Financial Statistics* database (IFS).

INV - Gross capital formation as percentage of GDP. Data is from the World Bank's *International Development Indicators* database. Where data was not available, I used data from the Penn World Tables.

lGDPX9 - Log of initial GDP per capita in current USD. From the World Bank's *International Development Indicators* database.[16]

SDRER - Standard deviation of log(real effective exchange rate). Where available, I have used the real effective exchange rate (2005 index) as given by the IMF IFS database. When missing I have used the exchange rate against the U.S. dollar, downloaded from the World Bank's *International Development Indicators* database, and the consumer price indeces from IMFs IFS database, in the following way:

$$RER_i = \frac{CPI_{US} * E}{CPI_i}, \quad E = \textit{The exchange rate against USD}$$

BS - Central government budget surplus as percentage of GDP. The data is from the IMF's *Government Finance Statistics* database. Where data was not available I used data from the World Bank's *International Development Indicators* database. For some values that were still missing, I used data from the IMF's *Government Finance Statistics* yearbooks from 1992 and 2000.

CPinf - Inflation (consumer prices). Arithmetic mean, truncated at 100 % if average inflation was above this level. The data is from the IMF's IFS database.

[16] For 1979, data was unavailable for Bahrain, Bhutan and Ethiopia. These were replaced with data from `http://kushnirs.org/macroeconomics/gdp`.

Hinf - *High inflation dummy.* A dummy that equals 1 if *CPinf* is above 25 % and 0 otherwise.

debtX9 - *Initial central government debt to GDP ratio.* Central government debt to GDP ratio in 1979, 1989 and 1999. The data is from the Inter-American Development bank's dataset *Public Debt around the World: A New Dataset of Central Government Debt.*

Hdebt - *High debt dummy.* A dummy that equals 1 if *debtX9* is above 90 % and 0 otherwise.

HIC - *Highly indebted country.* A dummy that equals 1 if the country was classified as a higly indebted country by the World Bank in 1989, and 0 otherwise.

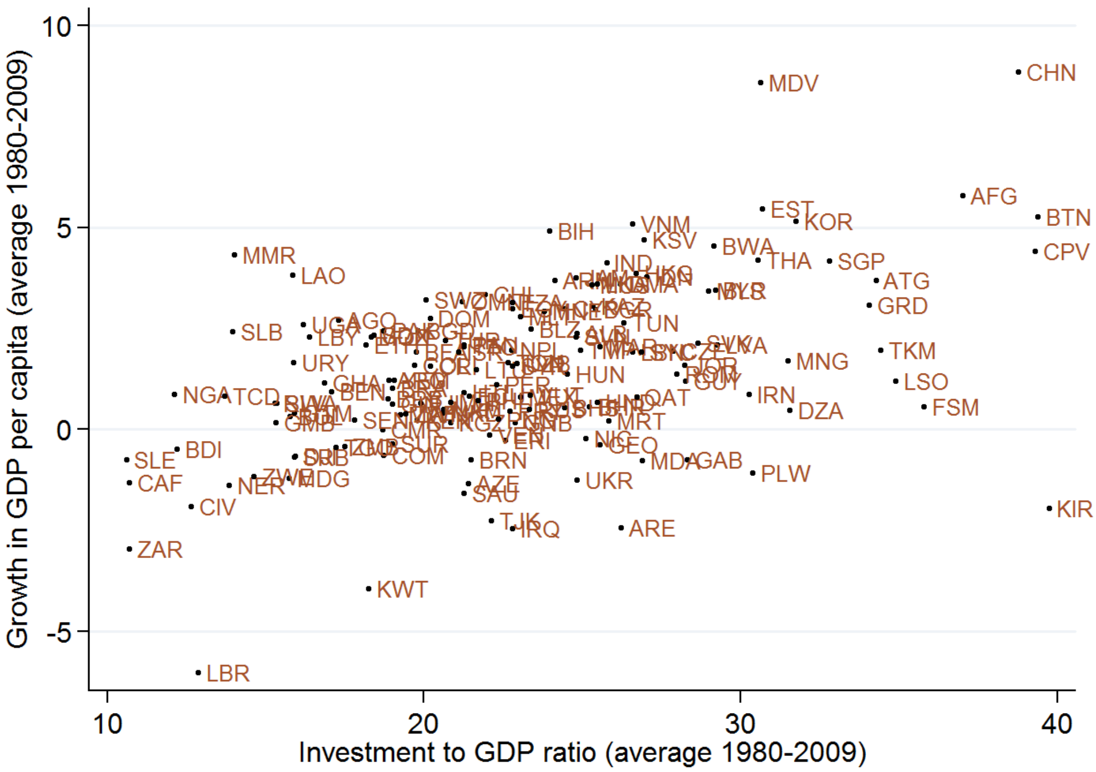
NXYgr - *Growth in the exports to GDP ratio.* Data from the IMF's IFS database.

NXYX9 - *Initial exports to GDP ratio.* Data from the IMF's IFS database.

Appendix B

FIGURES AND TABLES

Fig. 5: Investment to GDP ratio and per capita growth (average 1980-2009)



Tab. 8: Coefficient estimates on control variables (OLS regression)

	(1) GR	(2) GR	(3) GR	(4) GR
Lgr	-0.0120***	-0.00715**	-0.0109***	-0.00912***
	(-3.14)	(-2.30)	(-4.86)	(-5.55)
INV	0.253***	0.0709**	0.0833**	0.0970***
	(3.64)	(2.23)	(2.29)	(4.33)
NXYgr	0.000371	-0.000135	-0.000430	-0.000746*
	(0.40)	(-0.15)	(-0.70)	(-1.79)
lGDPX9	-0.0127***	0.00256	-0.00686***	-0.00455***
	(-3.56)	(1.02)	(-3.63)	(-3.44)
d90				0.00224
				(0.57)
d00				0.0102**
				(2.35)
Constant	0.0795**	0.00425	0.0788***	0.0522***
	(2.70)	(0.18)	(3.92)	(3.83)
N	44	52	70	166

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
d90 and *d00* are dummies for the 1990s and 2000s, respectively.

Tab. 9: Coefficient estimates on control variables (panel regression)

	(1) GR	(2) GR	(3) GR	(4) INV	(5) INV
Lgr	-0.00405	-0.00215	-0.00229		
	(-1.03)	(-0.47)	(-0.49)		
INV	0.0377	0.0401	0.0867**		
	(1.12)	(1.10)	(2.40)		
lGDPX9	-0.0361***	-0.0347***	-0.0353***		
	(-7.11)	(-5.93)	(-6.14)		
NXYgr	0.000410	0.000239	0.000155	0.0000130	-0.000885
	(1.02)	(0.55)	(0.36)	(0.01)	(-0.52)
d90	0.0141***	0.0174***	0.0178***	-0.00406	-0.00554
	(3.60)	(4.01)	(4.25)	(-0.31)	(-0.48)
d00	0.0326***	0.0365***	0.0365***	-0.0151	-0.0157
	(5.36)	(5.24)	(5.36)	(-1.00)	(-1.17)
NXYX9				-0.0340	-0.0592
				(-0.42)	(-0.80)
Constant	0.267***	0.256***	0.250***	0.270***	0.272***
	(7.42)	(6.23)	(6.25)	(8.92)	(10.19)
N	174	166	166	164	170

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Tab. 10: List of countries included in the regressions

Country	Code	80s	90s	00s	Country	Code	80s	90s	00s
Argentina	ARG	1	1	0	Kenya	KEN	1	1	1
Armenia	ARM	0	0	1	Korea	KOR	1	1	1
Bahamas	BHS	0	1	0	Latvia	LVA	0	0	1
Bahrain	BHR	1	1	0	Lesotho	LSO	0	1	1
Bangladesh	BGD	0	0	1	Lithuania	LTU	0	0	1
Belarus	BLR	0	0	1	Madagascar	MDG	0	1	1
Belize	BLZ	0	1	0	Malawi	MWI	1	0	0
Benin	BEN	0	0	1	Malaysia	MYS	1	1	1
Bhutan	BTN	0	1	1	Mali	MLI	0	0	1
Bolivia	BOL	1	1	1	Malta	MLT	1	1	1
Botswana	BWA	1	1	0	Mauritius	MUS	1	1	1
Brazil	BRA	1	1	1	Mexico	MEX	1	1	0
Bulgaria	BGR	0	0	1	Mongolia	MNG	0	0	1
Burkina Faso	BFA	1	0	1	Morocco	MAR	1	1	1
Burundi	BDI	0	1	0	Namibia	NAM	0	0	1
Cambodia	KHM	0	0	1	Nepal	NPL	1	1	1
Cameroon	CMR	0	1	0	Nicaragua	NIC	1	0	1
Chile	CHL	1	1	1	Pakistan	PAK	1	1	1
Colombia	COL	1	1	1	Panama	PAN	0	1	0
Congo	ZAR	0	0	1	Papua New Guinea	PNG	0	1	0
Costa Rica	CRI	1	1	1	Paraguay	PRY	1	1	1
Cote d'Ivoire	CIV	0	0	0	Peru	PER	1	1	1
Croatia	HRV	0	0	1	Philippines	PHL	1	1	1
Cyprus	CYP	1	1	1	Poland	POL	0	0	1
Czech Republic	CZE	0	0	1	Romania	ROM	0	0	1
Dominican Republic	DOM	1	1	1	Russia	RUS	0	0	1
Ecuador	ECU	1	0	0	Seychelles	SYC	0	1	1
Egypt	EGY	1	1	1	Sierra Leone	SLE	0	0	1
El Salvador	SLV	0	1	1	Slovak	SVK	0	0	1
Estonia	EST	0	0	1	Slovenia	SVN	0	0	1
Ethiopia	ETH	1	1	1	South Africa	ZAF	1	1	1
Fiji	FJI	1	1	0	Sri Lanka	LKA	1	1	1
Georgia	GEO	0	0	1	Syrian Arab Republic	SYR	0	1	0
Ghana	GHA	0	0	1	Thailand	THA	1	1	1
Guatemala	GTM	1	1	1	Togo	TGO	1	0	0
Honduras	HND	0	0	1	Trinidad and Tobago	TTO	1	0	1
Hong Kong	HKG	0	0	1	Tunisia	TUN	0	1	1
Hungary	HUN	0	1	1	Turkey	TUR	1	1	0
India	IND	1	1	1	Uganda	UGA	0	0	1
Indonesia	IDN	1	1	1	Ukraine	UKR	0	0	1
Iran	IRN	1	1	1	Uruguay	URY	1	1	1
Israel	ISR	1	1	1	Venezuela	VEN	1	1	0
Jamaica	JAM	0	1	1	Zambia	ZMB	0	0	1
Jordan	JOR	1	1	1	Zimbabwe	ZWE	1	0	0
Kazakhstan	KAZ	0	0	1	Sum		44	52	70

1 indicates that there is available data for that country in the respective decade. Countries with data available for at least two decades are included in the panel regression. There are 48 countries with data available for at least two decades. Toghether they form 126 observations, that are used to calculate the coefficients. The regression table (Tab. 5 (2)) reports N=166, because "Stata does not drop panels with only one observation, because they provide information about the constant, the variance components, the between R-sq, the overall R-sq and the correlation between the u_i and Xb" (Drukker, 2002).

Tab. 11: Main dataset

Country	Decade	GR	Lgr	INV	NXYgr	lGDPX9	BS	SDRER	CPinf	debtX9
Argentina	1980	-0.022	0.015	0.199	0.087	7.824	-0.055	0.429	1.000	0.146
Argentina	1990	0.032	0.013	0.178	-0.016	7.775	-0.003	0.162	1.000	0.731
Armenia	2000	0.087	0.000	0.289	-0.019	6.392	-0.017	0.151	0.035	0.643
Bahamas	1990	0.001	0.016	0.277	-0.011	9.406	-0.011	0.036	0.028	0.228
Bahrain	1980	-0.008	0.034	0.343	0.001	8.939	0.019	0.180	0.023	0.234
Bahrain	1990	0.027	0.027	0.188	-0.017	8.998	-0.010	0.039	0.008	0.188
Bangladesh	2000	0.043	0.014	0.239	0.041	5.884	-0.009	0.049	0.058	0.313
Belarus	2000	0.078	-0.005	0.295	-0.013	7.098	0.004	1.358	0.372	0.183
Belize	1990	0.028	0.028	0.237	-0.003	7.592	-0.046	0.020	0.022	0.377
Benin	2000	0.011	0.031	0.198	-0.022	5.933	-0.007	0.192	0.034	0.677
Bhutan	1990	0.053	0.000	0.396	0.026	6.212	0.005	0.090	0.099	0.539
Bhutan	2000	0.056	0.025	0.502	0.042	6.626	-0.022	0.101	0.049	0.405
Bolivia	1980	-0.026	0.022	0.153	0.064	6.739	-0.077	0.428	1.000	0.767
Bolivia	1990	0.017	0.022	0.169	-0.026	6.586	-0.025	0.041	0.104	0.876
Bolivia	2000	0.018	0.018	0.151	0.085	6.926	-0.034	0.101	0.051	0.724
Botswana	1980	0.078	0.034	0.300	0.029	6.750	0.092	0.219	0.108	0.159
Botswana	1990	0.032	0.025	0.291	-0.013	7.740	0.120	0.104	0.108	0.214
Brazil	1980	0.008	0.021	0.210	0.052	7.545	-0.086	0.164	1.000	0.372
Brazil	1990	0.001	0.016	0.185	0.013	7.970	-0.025	0.145	1.000	0.239
Brazil	2000	0.021	0.012	0.175	0.022	8.135	-0.024	0.198	0.069	0.416
Bulgaria	2000	0.055	-0.008	0.262	-0.001	7.385	0.014	0.132	0.068	0.816
Burkina Faso	1980	0.011	0.025	0.180	-0.001	5.514	-0.004	0.188	0.050	0.158
Burkina Faso	2000	0.023	0.029	0.188	0.033	5.530	-0.045	0.190	0.030	0.525
Burundi	1990	-0.028	0.014	0.091	0.049	5.317	-0.047	0.113	0.135	0.785
Cambodia	2000	0.069	0.013	0.191	0.043	5.662	-0.019	0.104	0.051	0.328
Cameroon	1990	-0.021	0.026	0.148	0.011	6.847	-0.019	0.212	0.056	0.321
Chile	1980	0.027	0.016	0.185	0.054	7.540	-0.005	0.305	0.214	0.438
Chile	1990	0.047	0.016	0.253	-0.017	7.692	0.012	0.100	0.118	0.487
Chile	2000	0.026	0.011	0.221	0.025	8.475	0.023	0.060	0.035	0.415
Colombia	1980	0.012	0.021	0.194	0.030	6.969	-0.026	0.290	0.235	0.182
Colombia	1990	0.010	0.018	0.199	0.006	7.102	-0.017	0.170	0.222	0.330
Colombia	2000	0.025	0.015	0.198	-0.011	7.698	-0.046	0.107	0.063	0.377
Congo	2000	0.007	0.028	0.128	-0.011	4.578	-0.008	0.647	1.000	3.065
Costa Rica	1980	-0.005	0.027	0.196	0.044	7.479	-0.023	0.171	0.271	0.524
Costa Rica	1990	0.029	0.025	0.187	0.042	7.738	-0.017	0.037	0.169	0.878
Costa Rica	2000	0.022	0.018	0.223	-0.017	8.324	-0.011	0.044	0.109	0.266
Croatia	2000	0.034	-0.003	0.261	-0.010	8.531	-0.028	0.054	0.032	0.428
Cyprus	1980	0.048	0.010	0.307	0.016	7.847	-0.050	0.073	0.058	0.225
Cyprus	1990	0.025	0.021	0.230	0.002	8.992	-0.024	0.026	0.039	0.509
Cyprus	2000	0.017	0.016	0.196	-0.022	9.564	-0.002	0.063	0.028	2.736
Czech Republic	2000	0.034	0.002	0.279	0.012	8.707	-0.039	0.141	0.028	0.337
Dominican Republic	1980	0.015	0.022	0.226	0.060	6.879	-0.015	0.266	0.209	0.228
Dominican Republic	1990	0.031	0.018	0.198	0.022	6.855	0.004	0.069	0.153	0.471
Dominican Republic	2000	0.036	0.015	0.182	-0.038	7.850	-0.008	0.117	0.131	0.216
Ecuador	1980	-0.003	0.026	0.202	0.018	7.122	-0.015	0.362	0.340	0.459
Egypt	1980	0.034	0.024	0.286	-0.023	6.024	-0.024	0.328	0.174	0.834
Egypt	1990	0.025	0.018	0.209	-0.008	6.568	0.009	0.174	0.105	0.416
Egypt	2000	0.030	0.018	0.189	0.061	7.219	-0.066	0.182	0.075	0.343
El Salvador	1990	0.037	0.012	0.170	0.038	6.723	-0.031	0.144	0.106	0.659
El Salvador	2000	0.016	0.004	0.161	-0.005	7.654	-0.024	0.037	0.036	0.404
Estonia	2000	0.048	-0.003	0.314	-0.004	8.331	0.010	0.225	0.043	0.392
Ethiopia	1980	0.012	0.030	0.154	-0.012	5.063	-0.069	0.051	0.046	0.094
Ethiopia	1990	-0.005	0.031	0.165	0.071	5.496	-0.039	0.418	0.080	0.327
Ethiopia	2000	0.055	0.024	0.226	-0.007	4.753	-0.039	0.216	0.109	0.698
Fiji	1980	-0.007	0.015	0.211	0.037	7.403	-0.037	0.173	0.075	0.173
Fiji	1990	0.021	0.011	0.181	-0.001	7.398	-0.029	0.058	0.042	0.336
Georgia	2000	0.060	-0.001	0.284	0.049	6.444	-0.009	0.112	0.063	0.590
Ghana	2000	0.029	0.024	0.229	0.055	6.022	-0.043	0.056	0.185	0.832
Guatemala	1980	-0.014	0.024	0.133	-0.009	6.913	-0.028	0.212	0.121	0.164
Guatemala	1990	0.017	0.023	0.155	0.012	6.871	-0.008	0.111	0.148	0.302
Guatemala	2000	0.009	0.025	0.190	0.030	7.420	-0.018	0.140	0.070	0.254
Honduras	2000	0.023	0.020	0.279	0.007	6.782	-0.013	0.074	0.082	0.830
Hong Kong	2000	0.036	0.006	0.229	0.044	10.130	0.019	0.076	-0.002	2.177
Hungary	1990	-0.002	-0.002	0.226	0.075	7.931	-0.059	0.098	0.222	0.628
Hungary	2000	0.025	-0.002	0.239	0.022	8.458	-0.057	0.119	0.061	0.543
India	1980	0.033	0.022	0.221	0.002	5.425	-0.021	0.111	0.088	0.124
India	1990	0.037	0.019	0.239	0.053	5.864	-0.028	0.103	0.095	0.511
India	2000	0.053	0.015	0.313	0.061	6.105	-0.036	0.100	0.056	0.224
Indonesia	1980	0.042	0.021	0.286	-0.011	5.924	-0.012	0.285	0.096	0.281
Indonesia	1990	0.033	0.015	0.276	0.067	6.328	0.004	0.315	0.145	0.437
Indonesia	2000	0.039	0.012	0.250	-0.033	6.499	-0.012	0.164	0.084	0.996
Iran	1980	-0.038	0.034	0.229	0.020	7.747	-0.078	0.210	0.198	0.098
Iran	1990	0.027	0.017	0.349	0.129	7.665	-0.010	0.451	0.237	0.053
Iran	2000	0.037	0.013	0.331	0.027	7.395	0.027	0.167	0.153	0.103
Israel	1980	0.018	0.018	0.206	-0.021	8.439	-0.059	0.048	1.000	0.852
Israel	1990	0.024	0.030	0.241	-0.004	9.197	-0.032	0.035	0.112	1.631
Israel	2000	0.015	0.020	0.187	0.006	9.803	-0.042	0.094	0.020	0.578
Jamaica	1990	0.013	0.008	0.269	-0.002	7.526	-0.039	0.175	0.278	1.131
Jamaica	2000	0.094	0.005	0.261	-0.009	8.140	-0.039	0.067	0.111	0.536
Jordan	1980	0.001	0.038	0.293	0.065	7.350	-0.081	0.131	0.070	0.434
Jordan	1990	0.006	0.043	0.294	-0.023	7.209	-0.010	0.014	0.051	1.721
Jordan	2000	0.041	0.023	0.261	0.009	7.463	-0.032	0.063	0.039	0.992
Kazakhstan	2000	0.078	0.008	0.282	0.013	7.030	0.008	0.229	0.092	0.350
Kenya	1980	0.004	0.037	0.232	-0.021	5.987	-0.060	0.142	0.118	0.314
Kenya	1990	-0.007	0.030	0.183	0.009	5.901	-0.025	0.104	0.174	0.503
Kenya	2000	0.010	0.026	0.179	0.014	6.048	-0.011	0.284	0.109	0.503
Korea	1980	0.064	0.012	0.304	0.022	7.466	0.011	0.114	0.084	0.363
Korea	1990	0.052	0.010	0.354	0.024	8.601	0.018	0.162	0.057	0.095
Korea	2000	0.038	0.005	0.295	0.034	9.165	0.019	0.116	0.031	0.316
Latvia	2000	0.054	-0.006	0.305	0.009	8.023	-0.017	0.202	0.059	0.447
Lesotho	1990	0.022	0.018	0.654	0.048	5.630	0.021	0.102	0.124	0.863
Lesotho	2000	0.027	0.011	0.297	0.065	6.004	0.031	0.168	0.077	0.692
Lithuania	2000	0.054	-0.005	0.222	0.038	8.043	-0.021	0.203	0.030	0.365

Country	Decade	GR	Lgr	INV	NXYgr	lGDPX9	BS	SDRER	CPinf	debtX9
Madagascar	1990	-0.015	0.031	0.124	0.044	5.430	-0.026	0.098	0.173	1.182
Madagascar	2000	0.001	0.030	0.242	0.039	5.520	-0.030	0.144	0.105	1.211
Malawi	1980	-0.023	0.040	0.194	-0.006	5.164	-0.080	0.080	0.168	0.559
Malaysia	1980	0.030	0.027	0.278	0.026	7.378	-0.058	0.143	0.037	0.229
Malaysia	1990	0.045	0.026	0.363	0.057	7.694	0.008	0.097	0.037	0.855
Malaysia	2000	0.027	0.020	0.230	-0.027	8.149	-0.040	0.035	0.022	0.522
Mali	2000	0.022	0.031	0.228	0.025	5.457	0.005	0.170	0.026	1.094
Malta	1980	0.029	0.011	0.258	-0.007	8.070	0.007	0.069	0.036	0.590
Malta	1990	0.044	0.008	0.255	0.004	8.706	-0.053	0.036	0.030	0.176
Malta	2000	0.011	0.009	0.178	0.003	9.240	-0.047	0.063	0.025	1.835
Mauritius	1980	0.033	0.010	0.236	0.045	7.153	-0.032	0.161	0.112	0.323
Mauritius	1990	0.040	0.011	0.282	0.000	7.644	-0.009	0.072	0.076	0.424
Mauritius	2000	0.034	0.008	0.242	-0.023	8.203	-0.021	0.085	0.060	0.306
Mexico	1980	0.002	0.021	0.223	0.067	7.603	-0.079	0.216	0.690	0.291
Mexico	1990	0.016	0.018	0.230	0.072	7.900	-0.007	0.135	0.204	0.469
Mongolia	2000	0.047	0.013	0.332	-0.005	6.093	0.002	0.129	0.090	0.795
Morocco	1980	0.014	0.024	0.241	0.007	6.719	-0.075	0.136	0.076	0.456
Morocco	1990	0.012	0.016	0.227	0.046	6.837	-0.026	0.052	0.044	1.153
Morocco	2000	0.036	0.011	0.299	0.013	7.232	-0.005	0.031	0.019	0.508
Namibia	2000	0.024	0.019	0.219	0.003	7.512	-0.013	0.182	0.064	0.186
Nepal	1980	0.017	0.024	0.199	-0.004	4.836	-0.065	0.118	0.108	0.077
Nepal	1990	0.023	0.025	0.227	0.086	5.243	-0.056	0.078	0.096	0.482
Nepal	2000	0.019	0.021	0.257	-0.056	5.353	-0.027	0.123	0.060	0.559
Nicaragua	1980	-0.032	0.025	0.214	0.027	6.210	-0.172	3.946	1.000	1.436
Nicaragua	2000	0.017	0.013	0.278	0.052	6.880	-0.019	0.061	0.087	1.751
Pakistan	1980	0.034	0.033	0.187	0.032	5.534	-0.068	0.210	0.073	0.373
Pakistan	1990	0.013	0.026	0.187	0.010	5.913	-0.056	0.047	0.097	0.756
Pakistan	2000	0.027	0.019	0.188	-0.015	6.100	-0.039	0.030	0.080	0.476
Panama	1990	0.035	0.020	0.247	-0.013	7.633	0.009	0.048	0.011	2.439
Papua New Guinea	1990	0.017	0.026	0.214	0.050	6.773	-0.022	0.118	0.087	0.651
Paraguay	1980	0.011	0.029	0.254	0.124	7.003	-0.001	0.254	0.202	0.257
Paraguay	1990	0.001	0.024	0.243	0.011	6.962	0.002	0.062	0.164	0.624
Paraguay	2000	0.002	0.019	0.186	0.030	7.239	0.001	0.126	0.083	0.465
Peru	1980	-0.020	0.023	0.257	-0.036	6.827	-0.043	0.321	1.000	0.598
Peru	1990	0.014	0.018	0.209	0.008	6.876	-0.019	0.085	1.000	0.516
Peru	2000	0.039	0.012	0.203	0.054	7.612	-0.005	0.063	0.026	0.553
Philippines	1980	-0.007	0.027	0.222	0.044	6.399	-0.028	0.172	0.149	0.450
Philippines	1990	0.004	0.023	0.227	0.052	6.563	-0.010	0.088	0.090	0.672
Philippines	2000	0.025	0.019	0.202	-0.031	7.000	-0.028	0.089	0.046	0.766
Poland	2000	0.041	-0.001	0.212	0.052	8.376	-0.041	0.079	0.036	0.323
Romania	2000	0.050	-0.005	0.245	0.013	7.368	-0.030	0.132	0.164	0.259
Russia	2000	0.058	-0.003	0.212	-0.042	7.200	0.039	0.200	0.140	0.892
Seychelles	1990	0.033	0.015	0.303	0.018	8.399	-0.067	0.048	0.020	0.440
Seychelles	2000	0.012	0.008	0.239	0.021	8.955	-0.013	0.139	0.094	0.337
Sierra Leone	2000	0.057	0.035	0.123	-0.007	5.113	-0.047	0.162	0.067	1.885
Slovak	2000	0.045	0.000	0.268	0.018	8.622	-0.043	0.217	0.055	0.471
Slovenia	2000	0.028	0.003	0.272	0.025	9.328	-0.015	0.148	0.049	0.315
South Africa	1980	-0.003	0.025	0.234	-0.022	7.638	-0.028	0.186	0.146	0.220
South Africa	1990	-0.008	0.022	0.167	-0.004	8.195	-0.048	0.086	0.099	0.382
South Africa	2000	0.022	0.013	0.182	0.015	8.040	-0.009	0.109	0.061	0.274
Sri Lanka	1980	0.026	0.015	0.262	-0.019	5.449	-0.112	0.065	0.128	0.447
Sri Lanka	1990	0.040	0.012	0.249	0.028	6.029	-0.064	0.044	0.113	0.717
Sri Lanka	2000	0.042	0.007	0.253	-0.047	6.711	-0.075	0.146	0.107	0.561
Syrian Arab Republic	1990	0.029	0.027	0.227	0.011	6.713	-0.003	0.163	0.082	2.059
Thailand	1980	0.053	0.019	0.294	0.048	6.378	-0.027	0.111	0.058	0.241
Thailand	1990	0.042	0.010	0.363	0.056	7.157	0.006	0.131	0.050	0.233
Thailand	2000	0.031	0.010	0.259	0.018	7.583	-0.007	0.109	0.024	0.719
Togo	1980	-0.006	0.032	0.195	0.032	5.840	-0.029	0.091	0.050	1.089
Trinidad and Tobago	1980	-0.025	0.013	0.225	0.001	8.375	-0.063	0.194	0.117	0.148
Trinidad and Tobago	2000	0.060	0.004	0.206	0.032	8.574	0.013	0.083	0.063	0.384
Tunisia	1990	0.033	0.017	0.260	-0.005	7.146	-0.023	0.014	0.049	0.534
Tunisia	2000	0.036	0.010	0.242	0.011	7.794	-0.023	0.086	0.032	0.570
Turkey	1980	0.019	0.021	0.195	0.031	7.637	-0.047	0.188	0.513	0.139
Turkey	1990	0.023	0.016	0.235	0.035	7.608	-0.059	0.094	0.772	0.382
Uganda	2000	0.038	0.032	0.213	0.069	5.543	-0.018	0.062	0.064	0.684
Ukraine	2000	0.055	-0.008	0.224	-0.011	6.455	-0.015	0.072	0.132	0.629
Uruguay	1980	0.001	0.006	0.149	0.062	7.816	-0.024	0.241	0.576	0.229
Uruguay	1990	0.030	0.006	0.154	-0.042	7.913	-0.009	0.203	0.489	0.327
Uruguay	2000	0.018	0.002	0.174	0.071	8.895	-0.024	0.138	0.086	0.608
Venezuela	1980	-0.029	0.028	0.215	0.029	8.250	0.020	0.324	0.230	0.422
Venezuela	1990	0.003	0.021	0.205	-0.019	7.689	0.001	0.245	0.474	0.725
Zambia	2000	0.026	0.025	0.218	0.037	5.752	-0.001	0.222	0.173	1.994
Zimbabwe	1980	0.014	0.037	0.173	-0.012	6.602	-0.089	0.173	0.128	0.135